

CHRYSLER MOTORS

1988

SERVICE MANUAL DODGE TRUCKS



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COMPONENT AND SYSTEM INDEX

Name	Group		
A/C Clutch	24	Engine Front Mounts	9
Accessories	1	Engine Lubrication	0
Accessory Drive Belts	7	Equipment Identification Label	Intro
A/C System Components	24	Engine Serial Number	Intro
Air Conditioning	24	Engine Rear Support	9
Air Injection System	25	Evaporating Control System	25
Alternator	8C	Exhaust System and Intake Manifold	11
Ash Tray	8E	Exhaust Gas Recirculation (EGR)	11
Aspirator Air System	25	Exhaust Pipes, Mufflers and Tailpipes	11
		Exterior Lamps	8L
Battery	8A	Fan	7
Belt Drives	7	Fixed Glass	23
Body	23	Four Speed Transmission	21
Body Lubrication	0	Frame Dimensions	13
Body Mechanisms	0	Frame Structures	13
Brakes	5	Front Coil Springs	2
		Front Driving Axle	2
Caliper	5	Front Suspension	2
Capacities	0	Fuse Block	8E
Camshaft	9	Fuel Delivery System	14
Carburetors	14	Fuel Filter	14
Carburetor Air Heater	11	Fusible Link Chart	8W
Catalytic Converter	11	Fuel Pump	14
Chassis Lubrication	0	Fuel System	14
Cigar Lighter	8E	Fuel Tank	14
Classification of Lubricants	0		
Cluster	8E	Glove Box	8E
Clutch	6		
Cooling System	7	Headliner	23
Coil Springs	17	Heater	24
Connecting Rods	9	Headlamps	8L
Crankshaft Main Bearing	9	Heater Controls	8E
Crankshaft Main Journal	9	Heated Inlet Air System	25
		Heated Rear Glass	8N
Defroster Duct	24	Hoisting	0
Distributor	8D	Horns	8G
Door Systems	23	Hood Release	8E
Drag Link	2	Hydraulic Tappets	9
Drive Lines	0		
Drum Brakes	5	Ignition System	8D
Dualmatic Locking Hub	2	Instrument Panel and Gauges	8E
		Interior Trim	23
Electrical	8		
Electrical Assist Choke System	25	Leaf Springs	17
Electronic Feedback Carburetor System	25	Lower Ball Joint	2
Electro-Hydraulic Unit	1	Lower Control Arm	2
Electric Locks	8P	Lubrication and Maintenance	0
Electronic Spark Control	8D		
Electrical Wiring and Component Identification	8W	Manifold Heat Control Valve	0,11
Emission Control System	25	Master Cylinder	5
Engines	9	Metric Thread and Grade Identification	Intro
Engine Air Cleaner	0		
Engine Block Heater	7	Noise Control Systems	0

COMPONENT AND SYSTEM INDEX

Oil Change Periods	0	Start Motor	8B
Oil Filters	0	Starter Relay	8B
Oil Pan	9	Steering Knuckle	2
Oil Pump	9	Steering	19
On Board Diagnostics	25	Steering Columns	19
		Stop Lamp Switch Adjustments	5
Paint Charts	23	Stop Lamp Switch	8H
Parts and Lubrication Recommendations	0	Sway Bar	2
Parking Brakes	5	Symbols, Fuses and Connectors	8W
Pistons, Pins, Rings	9		
Pivot Bearings	0	Thermostat	7
Pinion Setting Charts	2	Tie Rods	2
Power Angling Cylinders	1	Tires	22
Power Brakes	5	Timing Chain Cover, Oil Seal and Chain	9
Power Steering Pump	19	Torque References	Intro
Power Windows	85	Towing	0
Propeller Shaft	16	Transfer Case	21
Protection In Storage	0	Transmission	21
		Transmission Identification	Intro
Radiator	7	Transmission Oil Cooler	7
Radio, Antenna and Speakers	8F	Turn Signal and Hazard Warning Flasher	8J
Rear Axle	3		
Rear Springs	17	Universal Joints	16
Refinishing Procedures	23	Upper Ball Joint	2
Resistor Block	24	Upper Control Arm	2
Rocker Arms and Shaft Assembly	9		
		Valves and Springs	9
Safety Rim Wheels	22	Valve Timing	9
Seats	23	Vehicle Identification Plate	Intro
Seat Belts	23	Vehicle Safety Certification Labels	Intro
Seat Belt Warning System	8M	V.I.N. Code Chart	Intro
Servo	8H		
Sheet Metal	23	Water Pump	7
Shock Absorbers	2,17	Wheels	22
Snow Plow	1	Wheel Alignment	2
Snow Plow Control Wiring	1	Wheel Bearings	0
Snow Plow Exterior Lighting	1	Wheel Cylinder	5
Specifications	Intro	Wheel Stud Nut Tightening	5
Speed Control	8H	Wire Color Code Chart	8W
Spark Plugs	8D	Window Regulators	23
Spark Control Computer	8D	Windshield Wipers and Washers	8K
Springs	17	Wiring Diagrams	8W

FOREWORD

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operations. Information in this manual is divided into groups. Each group covers a general vehicle system (brakes, steering, body, etc.). Each group is further divided to address individual components or systems within the group.

The Component and System Index will assist you in locating the correct group for the component or system you require.

These groups contain general information, diagnosis, testing, adjustment, removal and installation, assembly and disassembly procedures for the components.

The diagnosis charts are designed to help you locate and correct problems with a systematic approach. The tab locator at the right side of this page will help you to quickly locate the first page of each group. The first page of each group contains an alphabetical index to assist in the location of the component or system.

The information, descriptions, testing procedures and specifications were in effect at the time this manual was released for printing.

Information describing the operation and use of standard and optional equipment is included in the Operating Instructions and Product Information manual located in the glove box.

GROUP	TITLE
	Introduction, General Specifications
0	Lubrication and Maintenance
1	Accessories
2	Front Suspension
3	Rear Axle
5	Service Brakes
6	Clutch
7	Cooling System
8	Electrical
9	Engine
11	Exhaust System
13	Frame Structures
14	Fuel System
16	Propeller Shaft and Universal Joints
17	Springs—Shock Absorbers
19	Steering
21	Transmission
22	Wheels and Tires
23	Body
24	Heating and Air-Conditioning
25	Emissions Control Systems

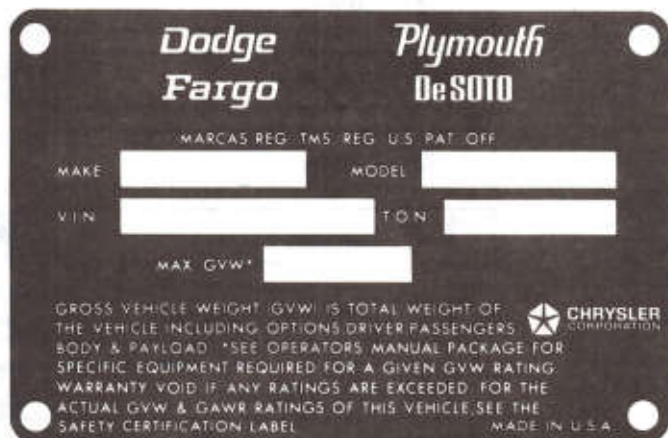
VEHICLE AND COMPONENT IDENTIFICATION

VEHICLE IDENTIFICATION NUMBER: For 1988, (V.I.N.) will consist of 17 elements (numbers and letters) embossed on a plate, located on the upper left corner of the instrument panel, near the windshield. Refer to 1988 "V.I.N. Code Chart," for Alpha/Digit positions and V.I.N. interpretations.

The Vehicle Identification Number is located on the Vehicle Identification Plate, Equipment Identification Plate and on the applicable U.S. Federal Motor Vehicle Safety Standards "Certification Label" and Frame Rail. (Figs. 1, 2 and 3).

Vehicle Identification Plate (Fig. 1)

The vehicle identification plate as shown in (Fig. 1) is attached to the rear face of the driver's door, or on the "B" post, on all models.



RN884

Fig. 1—Vehicle Identification Plate

Equipment Identification Plate (Fig. 2)

The equipment identification plate as shown in Figure 2, contains information regarding the vehicle: model, wheel base, V.I.N. (Vehicle Identification Number), T.O.N. (Order Number), and all production or special equipment on the vehicle when it was shipped from the factory. Always refer to this plate when ordering parts. The location of the Equipment Identification Plate is as follows:

Model	Location
Sport Utility	Hood Inner Surface
Conventional Cab	Hood Inner Surface
Conventional Cowl	Hood Inner Surface

Vehicle Safety Certification Labels

A vehicle safety certification label Figure 3 is attached to the rear facing of the drivers door on all models. This label reflects the date of manufacture numerically month and year, Gross Vehicle Weight Rating (GVWR), Gross Axle Weight Rating (GAWR) front, Gross Axle Weight Rating (GAWR) rear and Vehicle Identification Number (VIN). A Month-Day-Hour (MDH) number is included on this label and indicates the Month, Day and Hour of manufacture.

This label when applied, verifies vehicle confirmation to all applicable Federal Motor Vehicle Safety Standards in effect on the date of manufacture.

All communications or inquiries regarding the vehicle should include the Month-Day-Hour and Vehicle Identification Number.

 CHRYSLER CORPORATION		EQUIPMENT IDENTIFICATION		4215966
MODELS		V.I.N.		T.O.N.
CODE NO.	DESCRIPTION	CODE NO.	DESCRIPTION	

RRAAA2

Fig. 2—Equipment Identification Label

MFG BY		CHRYSLER CORPORATION		DATE OF MFG		GVWR	
GAWR FRONT		WITH TIRES		RIMS AT		PSI CODE	
GAWR REAR		WITH TIRES		RIMS AT		PSI CODE	
SINGLE DUAL		THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE					
VEHICLE NUMBER		VEHICLE TYPE		MDH			

PU834 4038800

Fig. 3—Vehicle Certification Label

ENGINE SERIAL NUMBER (Parts Replacement Information)

On 318 C.I.D. (5.2 liter) and 360 C.I.D. (5.9 liter) 8 cylinder engines, the engine serial number is located on the left front corner of the block, below the cylinder head.

On 238 C.I.D. (3.9 liter) 6 cylinder engine, the engine serial number is on a pad located on the right side of the block.

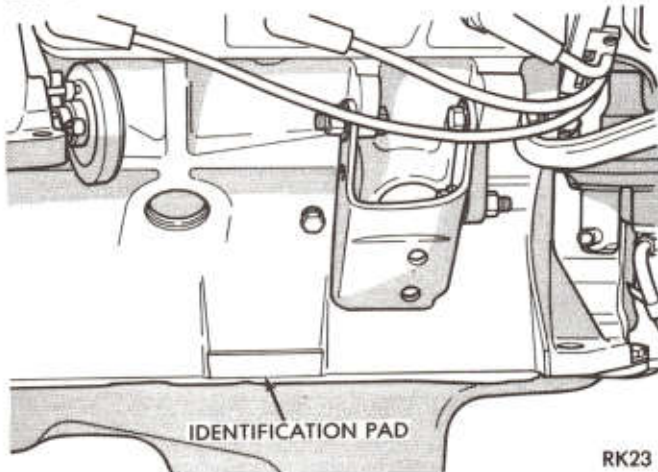


Fig. 4—318-360-Cubic Inch Engine Serial Number

TRANSMISSION IDENTIFICATION

Specific light and medium duty vehicles referred to in this manual can be identified by part number, model and build date supplied on the Transmission Identification Tag.

Operation requirements are, in some instances, different for each vehicle and engine combination and some internal parts will be different. Therefore, when replacing parts, refer to the number stamped on left side of the transmission oil pan flange.

See Group 21 of this manual for additional information.

For manual transmissions an aluminum identification Tag has been provided and is secured by two (2) bolts to the power take-off cover. Do not discard this tag in the event transmission power take-off cover is removed. On other transmission models, a blue metal identification tag is permanently attached to the left side of transmission case at the top near the case cover.

For automatic transmissions a surface pad has been provided on the right side of the transmission case to supply identification.

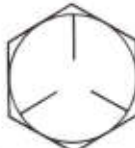
SAE CLASSIFICATION		
GRADE 5		GRADE 8
	MARKINGS FOUND ON TOP OF BOLT HEAD INDICATE GRADE	
120°		60°
		RN885

Fig. 5—Bolt Marking Identification

INCH		METRIC	
5/16-18		M8 X 1.25	
THREAD MAJOR DIAMETER IN INCHES	NUMBER OF THREADS PER INCH	THREAD MAJOR DIAMETER IN MILLIMETERS	DISTANCE BETWEEN THREADS IN MILLIMETERS

PR606B

Fig. 6—Thread Notation (Inch and Metric)

METRIC THREAD AND GRADE IDENTIFICATION

Metric and inch thread notations differ slightly. The difference is illustrated in (Fig. 6).

Common metric fastener strength property classes are 9.8 and 12.9 with the class identification embossed on the head of each bolt. (inch) strength classes range from grade 2 to 8 with line identification embossed on each bolt head as shown in (Figs. 5 and 7). Markings correspond to two lines less than the actual grade (i.e. grade 8 bolt will exhibit 6 embossed lines on the bolt head). Some metric nuts will be marked with single digit strength identification numbers on the nut face. (Fig. 8) illustrates the different strength markings.

METRIC SYSTEM

Artwork, specifications, and tightening references in this Service Manual are identified in the metric system and in the standard-inch system.

During any maintenance or repair procedures, it is important to salvage metric fasteners (nuts, bolts, etc.) for reassembly. If the fastener is not salvageable, a fastener of equivalent specification should be used. **Use of an incorrect fastener may result in component damage or personal injury.**

The metric system is based on quantities of one, ten, one hundred, one thousand, and one million.

METRIC PREFIXES

Mega - (M) means million

Kilo - (K) means thousand

Deci - (D) means tenth

Centi - (C) means hundredth

Milli - (M) means thousandth

The following tables will assist you in conversion procedures.

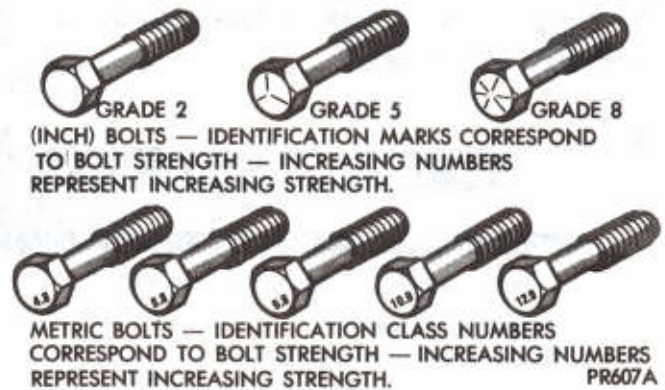


Fig. 7—Bolt Identification (Inch and Metric)

TORQUE REFERENCES

BOLT HEAD MARKINGS—Head marking identification consists of radial lines on the top of the bolt head (Fig. 5). These markings represent strength class.

1988 V.I.N. CODE CHARTS — TRUCKS

Position	Code Options	Interpretation
1	1 = United States 2 = Canada 3 = Mexico	Country of Origin
2	B = Dodge E = Fargo	Make
3	4 = Multipurpose Passenger 5 = Bus 6 = Incomplete 7 = Truck	Type of Vehicle
4	D = 1-3000 E = 3001-4000 F = 4001-5000 G = 5001-6000 H = 6001-7000 J = 7001-8000 K = 8001-9000 L = 9001-10000 M = 10001-14000 W = Bus or Incomplete Vehicle	GVWR and Hydraulic Brakes
5	B = Ram-Wagon/Van D = Ramcharger 4 x 2 Ram Pickup 4 x 2 Ram Chassis Cab 4 x 2 W = Ramcharger 4 x 4 Power Ram Pickup 4 x 4 Power Ram Chassis Cab 4 x 4	Truck Line
6	0 = 100 1 = 150 2 = 250 3 = 350	Series
7	1 = Wagon 2 = Sport Utility 3 = Van 4 = Conventional Cab 7 = Step Van 8 = Front Section	Body
8	X = 3.9L E.F.I. Y = 5.2L E.F.I. W = 5.9L 4BBL.	Engine
9	(1 thru 9, 0, or X)	"Check Digit" for VIN Verification
10	J = 1988	Model Year
11	S = Dodge City M = Lago Alberto	Assembly Plant
12 thru 17	(6 digits)	Sequence Number

1988 TRUCK MODEL LINE-UP AND WEIGHTS

Model Name	Vehicle Family	Wheelbase	GVWR	Payload Allowance ⁽¹⁾	Curb Weight ⁽²⁾
Pickup Trucks Two-Wheel Drive					
D100	D-1	115	4950	1398	3542
		131	5000	1363	3637
D150	D-1	115	4950	1449	3501
			5900	2310	3590
			6050	2272	3778
		131	5000	1407	3593
			6050	2371	3679
			6600	2639	3961
D250	D-2	131	7500	3730	3770
			8510	4571	3939
			8700	4725	3975
D350	D-3	131	8700	4725	3975
Pickup Trucks Four-Wheel Drive					
W100	D-5	115	6300	2042	4258
		131	6400	2023	4377
W150	D-5	115	6300	2069	4231
		131	6400	2053	4347
W250	D-6	131	6900	2419	4481
			7500	3005	4495
			8510	3832	4678
W350	D-7	131	8700	4005	4695

(1) Payload includes maximum weight of driver, passengers, cargo, and optional equipment not included in payload or GVW package

(2) Includes base engine

(3) Available with 3.9L engine only

1988 TRUCK MODEL LINE-UP AND WEIGHTS (CONT'D)

Model Name	Vehicle Family	Wheelbase	GVWR	Payload Allowance ⁽¹⁾	Curb Weight ⁽²⁾
Sport Utility					
Ramcharger	D-4	131	5600	1496	4104
Ramcharger	D-8	106	6000	1405	4595
4 x 4			6400	1791	4609
Chassis Cab Two-Wheel Drive					
D250	D-2	131	7500 ⁽³⁾	3730 ⁽⁴⁾	3770
			8510	4571 ⁽⁴⁾	3939
D350	D-3	131	8700	4725 ⁽⁴⁾	3975
		159	10,100	5868 ⁽⁴⁾	4232
			10,500	6102 ⁽⁴⁾	4398
		135	10,100	5801 ⁽⁴⁾	4299
			10,500	6179 ⁽⁴⁾	4321
Chassis Cab Four-Wheel Drive					
W250	D-6	131	8510	4226 ⁽⁴⁾	4284
W350	D-7	131	8700	4391 ⁽⁴⁾	4309
		135	10,100	5426 ⁽⁴⁾	4674
			11,000	6304 ⁽⁴⁾	4696

(1) Payload includes maximum weight of driver, passengers, cargo, and optional equipment not included in payload or GVW package

(2) Includes base engine

(3) N.A. California

(4) Body and payload allowance

1988 POWER TEAM AVAILABILITY
Chassis Cab

Vehicle Line	Wheelbase	GVWR	Engine Displacement/ Sales Code			Transmission		
			3.9L 239in ³ EHB	5.2L 318in ³ ELG	5.9L 360in ³ EMC	5-Spd O.D. Man	4-Spd Man	3-Spd Auto
Chassis Cab Two-Wheel Drive								
D250	131	7500	—	—	S(2)	—	—	S
		8510	—	—	S(3)	—	S	O
D350	131	8700	—	—	S(3)	—	S	O
	135	10,100	—	—	S(3)	—	S	O
	159	10,500	—	—	S(3)	—	S	O
Chassis Cab 4-Wheel Drive								
W250	131	8510	—	—	S(3)	—	S	O
W350	131	8700	—	—	S(3)	—	S	O
	135	10,100	—	—	S(3)	—	S	O
		11,000	—	—	S(3)	—	S	O

(2) N.A. in California

(3) N.A. California after 12-31-87

1988 POWER TEAM AVAILABILITY Conventional Pickup and Sport Utility

Vehicle Line	Wheelbase	GVWR	Engine Displacement/ Sales Code			Transmission		
			3.9L 239in ³ EHB	5.2L 318in ³ ELG	5.9L 360in ³ EMC	5-Sp O.D. Man	4-Sp Man	3-Sp Auto
Pickup Trucks Two-Wheel Drive								
D100	115	4950	S	O	O(e)	S(c)	O(a)	O
	131	5000	S	O	O(e)	S(c)	O(a)	O
D150	115	4950	S	O	O(e)	S(c)	O(a)	O
		5900	S	—	—	S	O(a)	O
	131	5000	S	O	O(e)	S(c)	O(a)	O
		6050	S	O	O(e)	S(c)	O(a)	O
D250	131	6600	S	O	O(a)	—	S(a)	O
		7500	S	O	O(a)	—	S(a)	O
		8450	—	S(f)	—	—	—	S
		8510	—	—	S(d)	—	S	O
D350	131	8700	—	—	S(d)	—	S	O
Pickup Trucks Four Wheel Drive								
W100	115	6300	—	S	O(a)	—	S(a)	O(b)
	131	6400	—	S	O(a)	—	S(a)	O(b)
W150	115	6300	—	S	O(a)	—	S(a)	O(b)
	131	6400	—	S	O(a)	—	S(a)	O(b)
W250	131	6900	—	S	O(a)	—	S(a)	O(b)
		7500	—	S	O(a)	—	S(a)	O(b)
		8450	—	S(f)	—	—	—	S
		8510	—	—	S(d)	—	S(a)	O(b)
W350	131	8700	—	—	S(d)	—	S	O
Sport Utility								
Ramcharger 4 x 2	106	5600	—	S	O(e)	—	—	S
Ramcharger 4 x 4	106	6000	—	S	O(e)	—	S(a)	O(b)
		6400	—	S	O(a)	—	S(a)	O(b)

S - Standard
O - Optional

(a) N.A. in California
(b) Standard in California
(c) N.A. with ELG or EMC engines
(d) N.A. California after 12-31-87
(e) Federal vehicle available in California
(f) Available California only after 1-1-88

STANDARD TRUCK BODY DIMENSIONS

Vehicle Family	Wheelbase Available (Inches)	Cab to Axle (Inches)	Body Type	Standard Bodies Available				
				Nominal Length (Ft.)	Load Space Dimensions ⁽²⁾			
					Length	Max. Width	Height	Volume (Cu. Ft.)
D1, D5	115	—	Sweptline	6.5	78	70	19.1	60.35
D1, D2, D3, D5, D6, D7	131	—	Sweptline	8	98	70	19.1	75.8
D2, D3, D7	131	56	Chassis Cab	8				
D3, D7	135	60	Chassis Cab	9.5				
D3	159	84	Chassis Cab	12.5				
D4	106		4 x 2 Sport Utility		70 ⁽³⁾	62.5	41.8	105.8
D8	106		4 x 4 Sport Utility		70 ⁽³⁾	62.5	41.8	105.8

(2) Based on S.A.E. Procedure J1100

(3) Driver Seat to Tailgate

FRACTION, DECIMAL, MILLIMETER, CONVERSIONS

8 THS.	16 THS.	32 NDS.	64 THS.	INCHES	MM	8 THS.	16 THS.	32 NDS.	64 THS.	INCHES	MM
			1	0.0156	0.397				33	0.5156	13.097
		1		0.0313	0.794			17		0.5313	13.494
			3	0.0469	1.191				35	0.5469	13.891
	1			0.0625	1.588		9			0.5625	14.288
			5	0.0781	1.984				37	0.5781	14.684
		3		0.0938	2.381			19		0.5938	15.081
			7	0.1094	2.778				39	0.6094	15.478
1				0.1250	3.175	5				0.6250	15.875
			9	0.1406	3.572				41	0.6406	16.272
		5		0.1563	3.969			21		0.6563	16.669
			11	0.1719	4.366				43	0.6719	17.066
	3			0.1875	4.763		11			0.6875	17.463
			13	0.2031	5.159				45	0.7031	17.859
		7		0.2188	5.556			23		0.7188	18.256
			15	0.2344	5.953				47	0.7344	18.653
1/4				0.2500	6.350	3/4				0.7500	19.050
			17	0.2656	6.747				49	0.7656	19.447
		9		0.2813	7.144			25		0.7813	19.844
			19	0.2969	7.541				51	0.7969	20.241
	5			0.3125	7.938		13			0.8125	20.638
			21	0.3281	8.334				53	0.8281	21.034
		11		0.3438	8.731			27		0.8438	21.431
			23	0.3594	9.128				55	0.8594	21.828
3				0.3750	9.525	7				0.8750	22.225
			25	0.3906	9.922				57	0.8906	22.622
		13		0.4063	10.319			29		0.9063	23.019
			27	0.4219	10.716				59	0.9219	23.416
	7			0.4375	11.113		15			0.9375	23.813
			29	0.4531	11.509				61	0.9531	24.209
		15		0.4688	11.906			31		0.9688	24.606
			31	0.4844	12.303				63	0.9844	25.003
1/2				0.5000	12.700	1 IN.				1.0000	25.400

CONVERSION FACTOR: 1 INCH = 25.4MM

LUBRICATION AND MAINTENANCE

CONTENTS

	Page		Page
CHASSIS AND BODY	25	ENGINE	10
DRIVE TRAIN	19	SERVICE INFORMATION	1

SERVICE INFORMATION

INDEX

	Page		Page
Assist (Jump) Starting	8	Maintenance Schedules	3
Chassis Lubrication	6	Noise Control Systems	1
Classification of Lubricants	2	Parts And Lubrication	
Fluid Capacities	8	Recommendations	8
Fuel Usage	2	Parts Requiring No Lubrication	2
General Information	1	Severe Service	1
Hoisting Recommendations	10		

GENERAL INFORMATION

Maintenance and lubrication service recommendations have been compiled to provide maximum protection for the owner's investment against all reasonable types of driving conditions. Since these conditions vary with the individual operator's driving habits, (area in which the vehicle is operated, and type of service to which the vehicle is subjected) it is necessary to prescribe lubrication and maintenance service on a time schedule as well as mileage interval basis.

All maintenance charts are related to a "Light" or "Heavy", "Duty Cycle" as follows:

"Light Duty Cycle"—Vehicles with a gross vehicle weight rating (GVWR) of 8,500 lbs. (3 855 kg) or less must meet light duty emission standards.

"Heavy Duty Cycle"—Vehicles with a gross vehicle weight rating of 8,501 lbs. (3 860 kg) or over must conform to heavy duty emission standards.

The GVWR for each vehicle as manufactured appears on the Safety Certification label, affixed to the lock pillar on the drivers door (Fig. 1).

Additional information can be found in the Operating Instructions and Product Information Manual provided with the vehicle.

 CHRYSLER CORPORATION		DATE OF MFG.	GVWR
SAVR FRONT	WITH TIRES	RIMS AT	PSI COLD
SAVR REAR	WITH TIRES	RIMS AT	PSI COLD
SINGLE ☐ DUAL ☐		40388000	
VEHICLE NUMBER	VEHICLE TYPE	MCH	

PU625

SEVERE SERVICE

Vehicles operating under one or more of the following conditions will require more frequent service.

- In extremely dusty areas.
- 50 percent or more of the vehicle operation in heavy city traffic in high temperatures (90 degrees or higher).
- Prolonged idling.
- Extremely short run operation.
- Commercial type operation.
- Operated in water.

NOISE CONTROL SYSTEMS

All vehicles built over 10,000 lbs. (4 535 kg) Gross Vehicle Weight Rating and manufactured after 1/1/78 for sale and use in the United States are required to comply with the Federal Government's Exterior Noise Regulations. These vehicles can be identified by the Noise Emissions Control Label located in the operator's compartment (Fig. 2).

Required Maintenance for Noise Control Systems

The following maintenance services must be performed every 6 months or 6,000 miles (9 600 km) whichever occurs first to assure proper operation of the noise control systems. Inspection and service should be performed anytime a malfunction is observed or suspected. In addition, proper maintenance of the entire vehicle will help the effectiveness of the noise control systems.

Fig. 1—Safety Certification Label

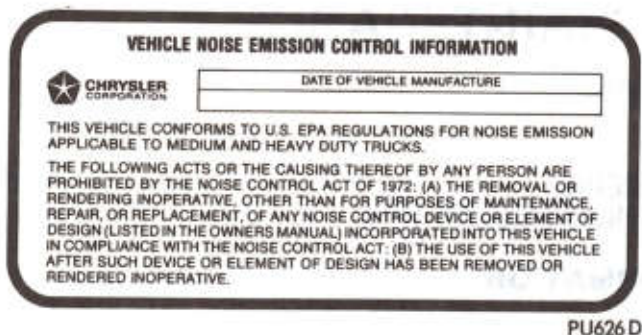


Fig. 2—Vehicle Emission Control Information Label

Exhaust System

Inspect the entire exhaust system for leaks and damaged parts. Devices such as hangers, clamps, and U-bolts should be tight and in good condition. Damaged components, burned or blown out mufflers, burned or rusted out exhaust pipes should be replaced according to the procedures and specifications outlined in "Exhaust," Group 11.

Air Cleaner Assembly

Inspect air cleaner housing for proper assembly and fit. Make certain that the air cleaner is properly positioned and indexed on the carburetor and the cover is tight. Check all hoses leading to the cleaner for tightness. The gasket between the air cleaner housing and carburetor must be intact and in good condition. The air filter element must also be clean and serviced according to the instructions outlined in the Scheduled Maintenance Section of this manual.

Tampering with Noise Control System Prohibited

Federal law prohibits the following acts or the causing thereof: (1) The removal or rendering inoperative by any person other than for purposes of maintenance repair, or replacement of any device or element of design incorporated into any new vehicle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use, (2) the use of the vehicle after such device or element of design has been removed or rendered inoperative by any person.

PARTS REQUIRING NO LUBRICATION

There are many points that should not be lubricated; some because they are permanently lubricated, some because lubricants will be detrimental to their operating characteristics, and some because lubricants will cause component failures. In particular, rubber bushings should not be lubricated since this

not only will cause them to fail, but will destroy their necessary frictional characteristics. Parts that should not be lubricated are as follows:

Air Pumps	Starter Bearings
Alternator Bearings	Suspension Strut Bearing
Drive Belts	Throttle Control Cable
Fan Belt Idler Pulley	Throttle Linkage
Idler Arm Assembly	Water Pump Bearings
Rubber Bushings	

FUEL USAGE

Use gasolines having a minimum octane rating of 87, (R + M)/2.

Unleaded gasolines only must be used in vehicles equipped with catalyst emission control systems. All vehicles, so equipped, have labels located on the instrument panel and adjacent to the fuel filler cap or door that state, "UNLEADED FUEL ONLY." These vehicles also have fuel filler tubes specially designed to accept the smaller diameter unleaded gasoline dispensing nozzles only. Refer to Engine section of this group.

The exhaust emission system of your vehicle is designed to meet all emission regulation while, at the same time, providing excellent fuel economy.

CLASSIFICATION OF LUBRICANTS

Oils, lubricants, and greases are classified and graded according to standards recommended by the Society of Automotive Engineers (SAE), American Petroleum Institute (API) and National Lubricating Grease Institute (NLGI).

Engine Oil

The SAE grade number indicates the viscosity of engine oils, for example, SAE 30, which is a single grade oil. Engine oils are also identified by a dual number, for example, SAE 10W-30, which indicates a multigrade oil.

Gear Lubricants

The SAE grade number also indicates the viscosity of Multipurpose Gear Lubricants.

The API classification system defines gear lubricants in terms of usage such as API GL-4 API GL-5 etc.

Lubricants/Greases

Semisolid lubricants, bear the NLGI designation and are further classified as grades 0,1,2,3 etc.

SCHEDULED MAINTENANCE FOR EMISSION CONTROL AND PROPER VEHICLE PERFORMANCE - LIGHT DUTY CYCLE

Inspection and Service should also be performed anytime a malfunction is observed or suspected

EMISSION CONTROL SYSTEM MAINTENANCE	Service Intervals (3)	Mileage in Thousands Kilometres in Thousands	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
			12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192
Alternator Brushes - Repalced At												•						
Carburetor Choke Shaft, Fast Idle Cam & Pivot Pin - Apply Solvent Every 12 Mo. 5.9L Engine	OR					X				•				•				•
Carburetor Choke - Check Heat Source (Electrical, Exhaust, Coolant) 5.9L Engine	AT				•2					•				•				•
Crankcase Inlet Air Cleaner - Clean	AT									•								•
Drive Belts - Inspect & Adjust Belt Tension: Replace As Necessary	AT		•2			X		•2		•		•		•		•		•
EGR - Check Valve Operation & Clean EGR Passages	AT								•3							•3		
Engine Air Filter - Replace or Clean						X				•				•				•
Engine Cooling System Condition - Check Every 12 months									•									
Engine Coolant - Flush & Replace At 36 Months (24 mos. Thereafter)									•									
Engine Oil - Change Every 12 Months	OR	X	X	X	X	X	X	X	•	•	•	•	•	•	•	•	•	•
Engine Oil Filter - Replace at Every Second Oil Change (1)			X			X		X		•		•		•		•		•
Fuel Filter - Replace as Necessary																		
Idle Speed - Check & Reset If Necessary (Propane Method)	AT								•									
Ignition Cables, Distributor Cap & Rotor - Replace (Inspect Distributor)	AT									•								•
Ignition Timing - Check & Adjust If Outside Specifications	AT									•								•
Manifold Heat Control Valve - Lubricate	AT									•								
Oxygen Sensor - Replace	AT												•3					
PCV Valve - Replace	AT									•3								•3
Spark Plugs - Replace	AT					X				•				•				•
Vacuum Operated Emission System Components - Inspect & Replace as Nec.										•								•

X = Scheduled Maintenance For All Vehicles

• = Scheduled Maintenance For All Except California Vehicles

Recommended Maintenance Required to Assure Proper Vehicle Performance For Vehicles Built For Sale in California.

(1) If mileage is less than 7,500 miles (12 000 km) each 12 months, replace oil filter at each oil change.

(2) For California vehicles, this maintenance is recommended by Chrysler but is not required to maintain the warranty on the air pump drive belt.

(3) Where time and mileage are shown, follow the interval which occurs first.

SCHEDULED MAINTENANCE FOR EMISSION CONTROL AND PROPER VEHICLE PERFORMANCE - HEAVY DUTY CYCLE VEHICLES WITH A DUAL AIR PUMP EXCEPT THOSE VEHICLES SOLD IN CALIFORNIA

Inspection and Service should be performed anytime a malfunction is observed or suspected

EMISSION CONTROL SYSTEM MAINTENANCE	Service Intervals (1)	Mileage in Thousands Kilometres in Thousands	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108
			9.6	19	29	38	48	58	67	77	85	96	106	116	125	135	145	154	164	174
Air Injection System - Check Valves, Switches, and A/Pump; Replace as Necessary	AT										X									X
Air Pump Air Filter - Replace	AT				X					X				X				X		
Alternator Brushes - Replace	AT														X					
Carburetor Choke Shaft, Fast Idle Cam & Pivot Pin - Apply Solvent Every 12 Months 5.9L Engine	OR		X		X		X		X			X		X		X		X		X
Carburetor Choke - Check Heat Source (Electrical) 5.9L Engine	AT		X		X		X		X			X		X		X		X		X
Carburetor Choke - Vacuum Kick and Fast Idle Cam - Adjust as Necessary 5.9L Engine			X		X		X		X			X		X		X		X		X
Crankcase Inlet Air Cleaner - Clean Every 12 Months	OR				X				X					X				X		
Drive Belts - Inspect & Adjust Belt Tension: Replace as Necessary	AT			X				X			X			X			X			X
Engine Air Filter - Replace or Clean	AT				X					X				X				X		
Engine Coolant - Flush & Replace 36 Mos. (24 mos. Thereafter)	OR									X										
Engine Cooling System Condition - Check Every 12 mos.																				
Engine Oil - Change Every 12 Months	OR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Engine Oil Filter - Replace At Every Second Oil Change (2)			X		X		X		X			X		X		X		X		X
Fuel Filter - Replace As Necessary																				
Gas Tank Cap - Inspect and Replace If Necessary	AT										X									X
Idle Speed - Check & Adjust (Propane Method)	AT										X									X
Ignition Cables, Distributor Cap & Rotor - Replace (Inspect Dist.)	AT										X									X
Ignition Timing - Check & Adjust as Required	AT											X								
Manifold Heat Control Valve - Apply Solvent	AT										X									X
PVC Valve - Replace	AT											X2								X
Spark Plugs - Replace	AT					X						X					X			
Vacuum Operated Emission System Components - Inspect & Replace If Necessary											X									

(1) Where both time and mileage are shown, follow the interval which occurs first.

(2) If mileage is less than 6,000 miles (9 600 km) each 12 months, replace oil filter at each oil change.

Inspection and service should be performed anytime a malfunction is observed or suspected.

SCHEDULED MAINTENANCE FOR EMISSION CONTROL AND PROPER VEHICLE PERFORMANCE - HEAVY DUTY CYCLE CALIFORNIA VEHICLES AND ALL FEDERAL VEHICLES EQUIPPED WITH A SINGLE AIR PUMP

Inspection and Service should be performed anytime a malfunction is observed or suspected

EMISSION CONTROL SYSTEM MAINTENANCE	Service Intervals	Mileage in Thousands (1) Kilometres in Thousands (1)	6	12	18	24	30	36	42	48
			9.6	19	29	38	48	58	67	77
Carburetor Choke Shaft, Fast Idle Cam & Pivot Pin - Apply Solvent Every 12 Months 5.9L Engine	OR			X		X		X		X
Carburetor Choke - Check Heat Source 5.9L Engine	AT			X		X		X		X
Carburetor Choke - Vacuum Kick and Fast Idle Cam - Check and Adjust If Necessary 5.9L Engine				X		X		X		X
Crankcase Inlet Air Cleaner - Clean Every 12 Months	OR			X		X		X		X
Drive Belts - Inspect & Adjust Belt Tension: Replace As Necessary	AT				X			X		
Engine Air Filter - Clean	AT			X				X		
Engine Air Filter - Replace	AT					X				X
Engine Oil - Change Every 12 Months	OR	X	X	X	X	X	X	X	X	X
Engine Oil Filter - Replace at Every Second Oil Change (2)				X		X		X		X
Fuel Filter - Replace As Necessary										
Ignition Cables - Inspect and Replace If Necessary	AT				X			X		
Ignition Timing and Idle Speed - Check and Adjust as Required	AT				X			X		
Manifold Heat Control Valve - Apply Solvent	AT				X			X		
PVC Valve - Check Operation and Replace If Necessary	AT			X				X		
PVC Valve - Replace	AT					X				X
Spark Plugs - Replace	AT				X			X		
Underhood Rubber & Plastic Components (Emission Hoses) - Check and Replace If Necessary	AT				X			X		

(1) Where both time and mileage are shown, follow the interval which occurs first.

(2) If mileage is less than 6,000 miles (9 600 km) each 12 months, replace oil filter at each oil change.

(3) Federal and Canada Only.

Inspection and service should be performed anytime a malfunction is observed or suspected.

CHASSIS LUBRICATION

For light duty cycle vehicles GVW rating of 8,500 lbs. (3 855 Kg) and below.

Component	Truck Models	Fittings	Service Interval	Lubricant
Center Link	D1-2, AD1	2	22,500 miles (36 000 km) or 2 years	Multi-purpose grease - NGLI grade 2 EP (Multi-Mileage Lubricant)
Drag Link Ball joints	W1-2, AW1	2	7,500 miles (12 000 km) or 6 months	Multi-purpose grease - NGLI grade 2 EP (Multi-Mileage Lubricant)
Gearshift Mechanism Overdrive 4	D1	1	22,500 miles (36 000 km) or 2 years	Multi-purpose grease - NGLI grade 2 EP (Multi-Purpose Lubricant)
Parking Brake Ratio Lever Pivot	D1-2, W1, AD1 AW1		22,500 miles (36 000 km) or 2 years	Multi-purpose grease - NGLI grade 2 EP (Multi-Purpose Lubricant)
Propeller Shaft U-joint	W1-2, AW1	3 (1 Piece rear P/shaft)	7,500 miles (12 000 km) or 6 months	Multi-purpose greases - NGLI grade 2 EP (Multi-Purpose Lubricant)
Propeller Shaft Slip Spline	D1-2, (with 2 piece P/shaft)	1	22,500 miles (36 000 km) or 2 years. For severe service, every 3,000 miles (4 800 km) or 3 months. Daily, if vehicle is operated in water	Multi-purpose grease - NGLI grade 2 EP (Multi-Purpose Lubricant)
Suspension Ball Joints	D1-2	4	22,500 miles (36 000 km) or 2 years — every engine oil change for off-highway operation	Multi-purpose grease - NGLI grade 2 EP (Multi-Mileage Lubricant)
Tie Rod Ball Joints	D1-2, AD1	4	22,500 miles (36 000 km) or 2 years	Multi-purpose grease - NGLI grade 2 EP (Multi-Mileage Lubricant)
	W1-2, AW1	2	7,500 miles (12 000 km) or 6 months. Daily, if vehicle is operated in water	
NP-241 Transfer Case Shift Lever Pivot	W1-2, AW1		As Required	Multi-purpose grease - NGLI grade 2 EP (Multi-Purpose Lubricant)
Wheel Stop	D1-2, AD1		22,500 miles (36 000 km) or as required	Wax Type Lubricant
Constant Velocity Joint (Front P/shaft)	W1-2, AW1	1	7,500 miles (12 000 km)	Multi-purpose grease - NGLI grade 2 EP (Multi-Purpose Lubricant)

CHASSIS LUBRICATION

For heavy duty cycle vehicles GVW rating of 8,500 lbs. (3 855 Kg) and above.

Component	Truck Models	Fittings	Service Interval	Lubricant
Center Link	D2-3	2	24,000 miles (19 000 km) or 2 years	Multi-purpose grears - NGLI grade 2 EP (Multi-Mileage Lubricant)
Drag Link Ball Joints	W3	2	6,000 miles (9 600 km) or 6 months	Multi-purpose grease - NGLI grade 2 EP (Multi-Mileage Lubricant)
Constant Velocity Joint (Front P/shaft)	W3	1	6,000 miles (9 600 km)	Multi-purpose grease - NGLI grade 2 EP (Multi-Purpose Lubricant)
P/shaft U-Joints	W3	3	6,000 miles (9 600 km) or 6 months. For severe service, every 1,000 miles (1 600 km). Daily, if vehicle is operated in water.	Multi-purpose grease - NGLI grade 2 EP (Multi-Purpose Lubricant)
P/shaft Slip Spline	W3 (135" WB)	1	24,000 miles (39 000 km) or 2 years. For severe service every 3,000 miles (4 800 km) or 3 months. Daily, if vehicle is operated in water.	Multi-purpose grease - NGLI grade 2 EP (Multi-Purpose Lubricant)
Suspension Ball Joints	D2-3	4	24,000 miles (39 000 km)	Multi-purpose grease - NGLI grade 2 EP (Multi-Mileage Lubricant)
Tie Rod Ball Joints	D2-3	4	24,000 miles (39 000 km) or 2 years	Multi-Purpose grease - NGLI grade 2 EP (Multi-Mileage Lubricant)
	W2-3	2	6,000 miles (9 600 km) or 6 months	
NP-205 Transfer Case Shift Linkage	W2-3		As required	Light Engine Oil
NP-241 Transfer Case Shift Lever Pivot	W2		As required	Multi-purpose grease - NGLI grade 2 EP (Multi-Purpose Lubricant)

FLUID CAPACITIES

ENGINE CRANKCASE		
3.9L (238 cu. in.)	4.0 Qts.*	3.8 liters*
5.2L-5.9L (318-360 cu. in.)	4.0 Qts.°	3.8 liters°
*With or Without Filter Change °Add 1 Qt. (0.9L) for filter change		
COOLING SYSTEM		
3.9L (238 cu. in.)	15.1 Qts.	14.3 liters
5.2L (318 cu. in.)	17.0 Qts.	16.1 liters
5.9L (360 cu. in.)	15.5 Qts.	14.7 liters
FRONT AXLE		
Spicer 44 FBJ	5.6 pts.	2.7 liters
Spicer 60	6.5 pts.	3.1 liters
REAR AXLE		
8-3/8 Inch (Chrysler)	4.4 pts.	2.1 liters
9-1/4 Inch (Chrysler)	4.5 pts.	2.1 liters
Dana 60	6.0 pts.	2.9 liters
Dana 70	7.0 pts.	3.3 liters
TRANSMISSION		
Manual Shift		
NP435 (Overdrive-4)	3.5 Qts.	3.3 liters
NP2500 (5-speed)	2.0 Qts.	1.9 liters
Automatic		
A-904	8.6 Qts.	8.2 liters
A-999	8.6 Qts.	8.2 liters
A-727	8.4 Qts.	8.0 liters
TRANSFER CASE 4WD MODELS		
NP-205	4.5 pts.	2.1 liters
NP-241	4.6 pts.	2.2 liters
FUEL TANK		
Standard 3.9L and 5.2L Engines	22 gals.	50.0 liters
Optional 3.9L and 5.2L Engines	30 gals.	68 liters
Standard 5.9L Engine	30 gals.	68 liters
AD100-AW100	34 gals.	129.0 liters
POWER STEERING		
All	2.7 pts.	1.29 liters

PARTS AND LUBRICATION
RECOMMENDATIONS

"Your Chrysler Motors vehicle has been engineered to perform for you for years to come. You will occasionally require service and maintenance for your vehicle and **Chrysler Motors recommends the use of "MOPAR" brand parts and accessories.** Each MOPAR part has been specifically designed to maintain top efficiency and quality by the same team of engineers who designed your vehicle. Only MOPAR can make this claim.

Remember, whenever your Chrysler, Dodge or Plymouth requires a new part, always request the brand

name MOPAR—it's worth the effort!

ASSIST (JUMP) STARTING

With a Booster Battery

If it becomes necessary to use a booster battery, with jumper cables, to start a vehicle's engine because its battery is discharged, the following procedure should be followed:

WARNING: TO PREVENT PERSONAL INJURY OR DAMAGE TO CLOTHING, DO NOT ALLOW BATTERY FLUID TO CONTACT EYES, SKIN OR FABRICS. DO NOT LEAN OVER A BATTERY WHEN CONNECTING JUMPER CABLES OR ALLOW CABLE CLAMPS TO

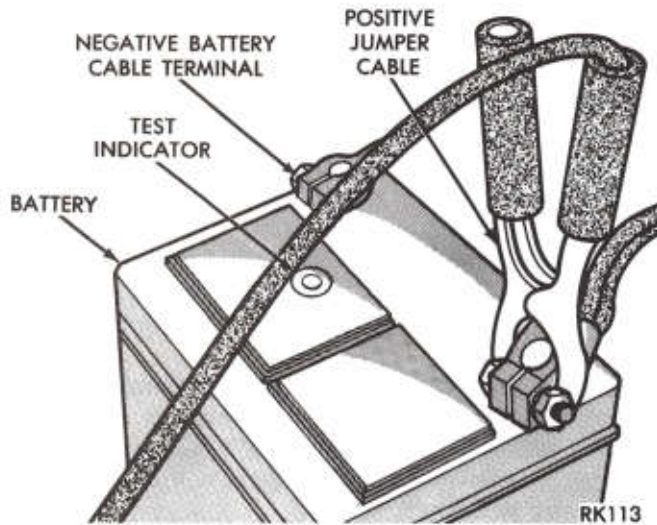


Fig. 1—Connecting Positive Jumper Cable

TOUCH EACH OTHER. KEEP OPEN FLAMES OR SPARKS AWAY FROM BATTERY VENT HOLES. ALWAYS WEAR EYE PROTECTION WHEN WORKING WITH BATTERIES.

(1) Set parking brake and place automatic transmission in "Park" (neutral for manual transmission). Turn off lights, heater and other electrical loads. Observe charge indicator. If indicator is light or yellow replace battery. **Do not** attempt jump starting when indicator is light or yellow. If charge indicator is dark and has a green dot in the center, failure to start is not due to a discharged battery and cranking system should be checked. If charge indicator is **dark or red ball** appears in center, proceed as follows:

(2) Attach one end of one jumper cable to positive terminal of booster battery and other end of the same cable to positive terminal of discharged battery (Fig. 1).

WARNING: DO NOT PERMIT VEHICLES TO TOUCH EACH OTHER AS THIS COULD ESTABLISH A

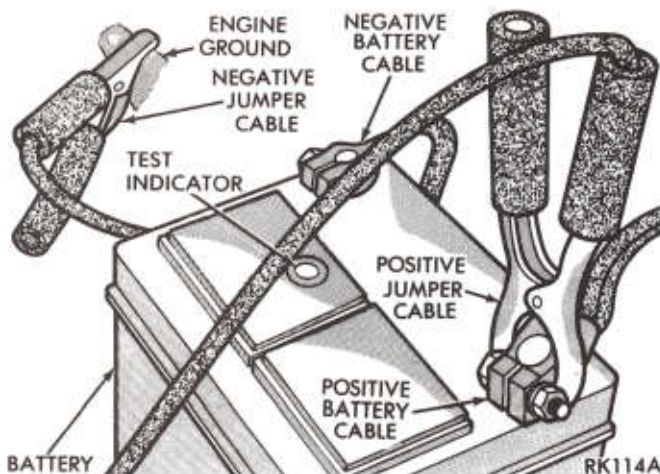


Fig. 2—Both Jumper Cables Connected

GROUND CONNECTION AND COUNTERACT BENEFIT OF THIS PROCEDURE.

(3) Connect **One** end of other jumper cable to **Negative (-) Post** of booster battery. Connect end of jumper cable to good engine ground free from dirt or grease of vehicle with discharged battery, making sure a good connection is made.

WARNING: DO NOT CONNECT TO NEGATIVE POST OF DISCHARGED BATTERY (Fig. 2).

(4) Take care that clamps from one cable do not inadvertently touch clamps on other cable. **Do not lean over battery when making connections.** The negative connection must provide good electrical conductivity and current carrying capacity.

WARNING: DURING COLD WEATHER WHEN TEMPERATURES ARE BELOW FREEZING POINT, ELECTROLYTE IN A DISCHARGED BATTERY MAY FREEZE. DO NOT ATTEMPT JUMP STARTING BECAUSE BATTERY COULD RUPTURE OR EXPLODE. BATTERY TEMPERATURE MUST BE BROUGHT UP ABOVE FREEZING POINT BEFORE ATTEMPTING JUMP STARTING.

(5) After engine is started or if engine fails to start, cables must be disconnected in following order;

(a) negative cable at engine ground.

(b) negative cable at negative post on booster battery.

(c) cable between positive post of both batteries.

WARNING: ANY PROCEDURE OTHER THAN ABOVE COULD RESULT IN: 1) PERSONAL INJURY CAUSED BY ELECTROLYTE SQUIRTING OUT BATTERY VENT, 2) PERSONAL INJURY OR PROPERTY DAMAGE DUE TO BATTERY EXPLOSION, 3) DAMAGE TO CHARGING SYSTEM OF BOOSTER VEHICLE OR OF IMMOBILIZED VEHICLE.

Assist (Jump) Starting With Portable Starting Unit

There are many types of these units available. Follow instructions of their manufacturer for necessary precautions and operation.

CAUTION: However, it is very important that their operating voltage does not exceed 16 volts because damage to battery, starter motor, alternator or electrical system may occur.

HOISTING RECOMMENDATIONS (Fig. 3)

See the Operating Instructions and Product Information Manual for "Emergency Jacking" procedures.

Twin Post

Lift points for twin post hoisting are shown (Fig. 3). Suitable hoist adaptors are available from hoist manufacturers.

Floor Jack

A regular floor jack may be used to raise the vehicle

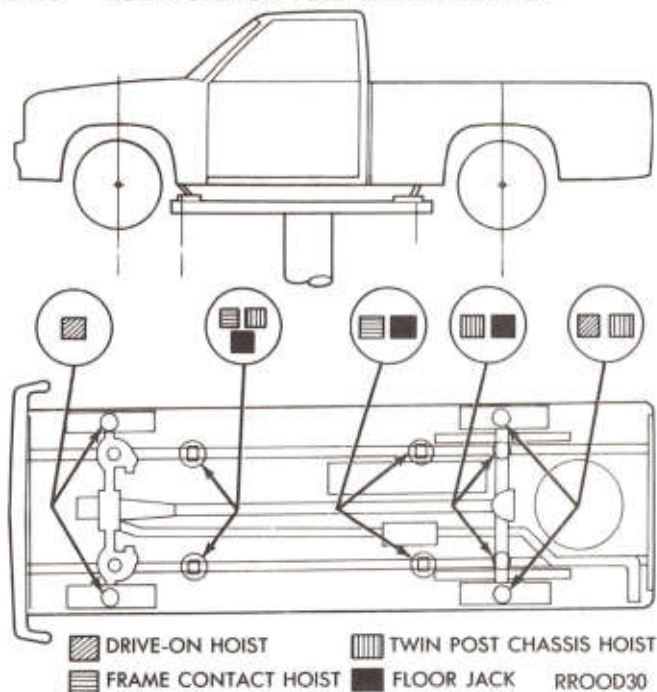


Fig. 3—Hoisting and Jacking Points

at the locations described (Fig. 3) (with the exceptions and precautions). In addition, a front jacking point is located at the center of the front crossmember (inboard).

Single Post/Outboard Twin Post

Frame contact lift points for single post hoist are shown (Fig. 3).

WARNING: WHEN SERVICE PROCEDURES REQUIRE REMOVING REAR AXLE, FUEL TANK, SPARE TIRE AND LIFT GATE. PLACE ADDITIONAL WEIGHT ON REAR END OF VEHICLE, ANCHOR VEHICLE TO HOIST OR PLACE JACK STANDS UNDER VEHICLE

FOR SUPPORT TO PREVENT TIPPING WHEN CENTER OF GRAVITY CHANGES.

Hoisting (4-Wheel Drive Models)

A conventional hydraulic hoist may be used after inspecting and adjusting lifting arms, pads or ramps to provide clearance between transfer case or skid plate during lifting procedure (Fig. 4).

If a twin post hoist is used a 4 x 4 x 12 inch wood spacer may be required under the front axle tube (opposite differential housing) to maintain a level lifting position.

CAUTION: Any blocking or spacer material used for increasing lift height must be secured in a safe manner that will not unbalance the vehicle or damage components such as hydraulic lines, exhaust system or steering linkage.

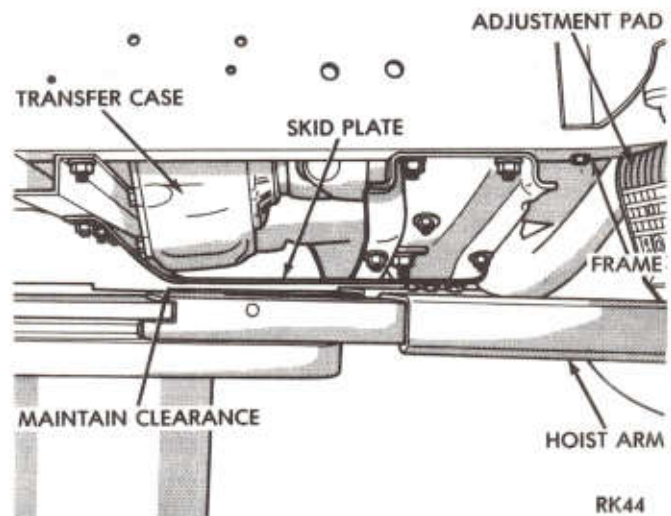


Fig. 4—Hoisting (Single Post Hoist Typical)

ENGINE

INDEX

	Page
Air Conditioning Compressor	19
Air Injection System	15
Alternator	18
Battery	17
Carburetor Choke Valve 5.9L Engine	14
Cooling System	12
Crankcase Inlet Air Filter	16
Crankcase Ventilation System	15
Engine Air Cleaner	13
Engine Oil	10
Engine Oil and Filter Changes	12
Engine Oil Filter Selection	12

	Page
Exhaust Gas Recirculation	17
Fuel System	16
Idle Adjustment (Propane Method)	17
Ignition Cables, Distributor Cap, and Rotor	17
Ignition Timing	17
Manifold Heat Control Valve 5.9L Engine	14
Oxygen (O ₂) Sensor	17
Rubber and Plastic Component Inspection	18
Spark Plugs	17
Throttle Control Linkage	14
Vacuum Operated Components	17

ENGINE OIL

During Break-In

The crankcase oil installed in the engine at the

factory is a high quality, energy conserving type lubricant. Oil changes should be consistent with anticipated climatic conditions under which vehicle operation will occur. The recommended SAE viscosity

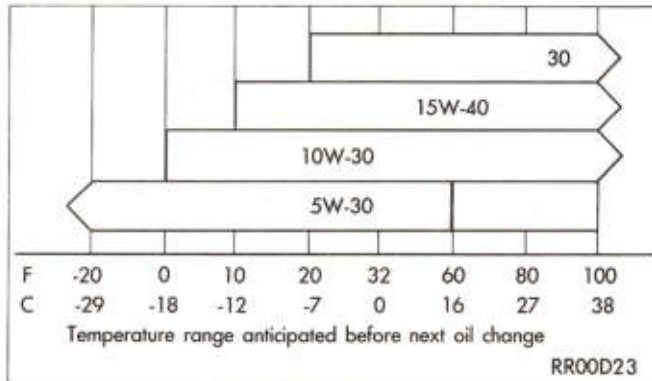


Fig. 1—Recommended Viscosity Grades

grades are shown in (Fig. 1). Only oils with the proper API quality classification should be used when adding or changing the crankcase engine oil. **NONDETERGENT OR STRAIGHT MINERAL OILS MUST NEVER BE USED.**

Frequently a new engine will consume some oil during its first few thousand miles of operation. This should be considered as a normal part of break-in and not interpreted as an indication of difficulty.

Selecting Engine Oil

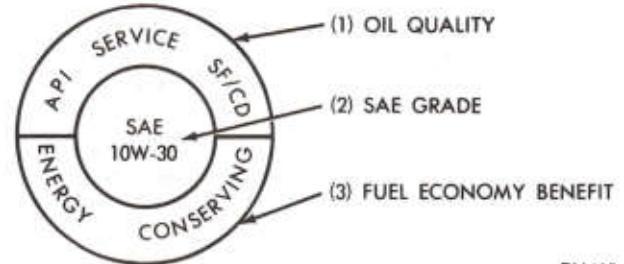
WARNING: TEST RESULTS SUBMITTED TO EPA HAVE SHOWN THAT LABORATORY ANIMALS DEVELOP SKIN CANCER AFTER PROLONGED CONTACT WITH USED ENGINE OIL. ACCORDINGLY, THE POTENTIAL EXISTS FOR HUMANS TO DEVELOP A NUMBER OF SKIN DISORDERS, INCLUDING CANCER, FROM SUCH EXPOSURE TO USED ENGINE OIL. CARE SHOULD BE TAKEN, THEREFORE, WHEN CHANGING ENGINE OIL, TO MINIMIZE THAT AMOUNT AND LENGTH OF EXPOSURE TIME TO USED ENGINE OIL ON YOUR SKIN. PROTECTIVE CLOTHING AND GLOVES, THAT CANNOT BE PENETRATED BY OIL, SHOULD BE WORN. THE SKIN SHOULD BE THOROUGHLY WASHED WITH SOAP AND WATER, OR USE WATERLESS HAND CLEANER, TO REMOVE ANY USED ENGINE OIL. DO NOT USE GASOLINE, THINNERS, OR SOLVENTS.

For best performance and to provide for maximum protection for all engines under all types of operation, only those lubricants should be selected which:

- (1) Conform to the API quality level classifications, for service SF or SF/CC. (Fig. 2).
- (2) Have the proper SAE grade number for the expected ambient temperature range as indicated in (Fig. 1).

To assure use of properly formulated engine oils, it is recommended that Mopar oils, or an equivalent that meets Chrysler Material Standard MS-6395, be used.

Engine oil viscosity grades SAE 10W-40 and 10W-50 are not recommended in Dodge Trucks.



RH469

Fig. 2—Oil Container Logo

Lubricants not having both an SAE grade number and the proper API service classification shown on the container **should not** be used.

Low viscosity oils make engine starting easier in cold weather. As stated in the chart (Fig. 1), oils of the SAE 5W-30 or 5W-40 grade number are preferred when minimum temperatures consistently fall below +10°F (-12°C) (Fig. 3).

Engine Oil Identification Logo

A new logo or symbol has recently been developed to aid the vehicle owner in the proper selection of engine oil.

This logo (Fig. 2) is located on the oil container and is composed of three distinct areas for identifying various aspects of the oil.

- (1) The top portion will indicate the quality of the



RN952

Fig. 3—Shaded Areas Cover Regions Where Minimum Temperatures May Be Consistently Below -12° (+10°F) During Some Winter Months

oil such as "SF", "SF/CC, or "SF/CD".

(2) The center portion, to be used by most oil marketers, will show the SAE viscosity grade of the oil, such as SAE 10W-30.

(3) The lower portion will state "ENERGY CONSERVING" if so applicable to that oil. Energy conserving, when shown, indicates, that oil offers fuel economy benefits in gasoline engines.

Energy Conserving Engine Oils

There are many engine oils currently available that could increase the fuel economy of your vehicle. They are marketed as "ENERGY CONSERVING," "FUEL SAVING," "FUEL EFFICIENT," "GAS SAVING," etc. . . .

Oils of this type are now identified on the lower portion of the new engine oil identification logo described above.

In addition to selecting proper API quality classification and SAE viscosity grade, use of energy conserving type engine oil formulations is recommended.

Engine Oil Level Indicator

The engine oil level indicator dip-stick is located on the right front of the engine, left of the alternator.

Checking Engine Oil Level

To assure proper lubricant of your vehicle's engine, the engine oil must be maintained at the correct level. Check the oil level at regular intervals, such as every fuel stop. Add oil only when level on the dipstick is at or below the Add Oil mark.

CAUTION: Do not overfill crankcase. This will cause oil aeration and loss of oil pressure.

Materials Added to Engine Oils

It is not necessary to add any material to crankcase oils for most types of vehicle operation. In some instances, such as infrequent operation or short trips only and during break-in after a major overhaul and/or new piston installation, addition of special materials containing anti-rust and anti-scuff additives are beneficial. Engine Oil Supplement, MOPAR Part Number 4318002, or equivalent, is a suitable product for this purpose.

ENGINE OIL FILTER SELECTION

All engines are equipped with full-flow, throwaway oil filters. The same type of replacement filter, depending on engine size (see chart) is recommended as a replacement filter in service on these vehicles. It is possible, particularly in cold weather, that the vehicle may develop high oil pressure for a short duration.

The quality of replacement filters varies considerably. Be sure that any replacement filter used is high

quality filter, and is capable of withstanding pressure of 256 psi (manufacturer's specifications) to avoid filter and engine damage. The following are high quality filters and are recommended for the engine size indicated:

Engine Size	Recommended Filter (or equivalent)
5.2L and 5.9L	MOPAR Engine Oil Filter Part No. 3549957
3.9L	MOPAR Engine Oil Filter, Part No. 4105409

ENGINE OIL AND FILTER CHANGES

Engine Oil

Engine oil should be changed at the following intervals:

(1) Light Duty cycle; Every 12 months or 7,500 miles (12 000 km), whichever occurs first.

(2) Heavy Duty Cycle; Every 12 months or 6,000 miles (9 600 km), whichever occurs first.

(3) Severe Service; Every 3 months or 3,000 miles (4 800 km), whichever occurs first, if the vehicle is driven under any of the following conditions:

- Frequent driving in dusty conditions
- Frequent trailer pulling
- Extensive idling
- Frequent short trip driving (less than 8 kilometers; 5 miles) at temperatures below -12°C ($+10^{\circ}\text{F}$) (Fig. 3).
- More than 50% operation at sustained high speeds over 112 km/h (70 mph) during hot weather (above $+32^{\circ}\text{C}$; $+90^{\circ}\text{F}$).

CAUTION: Do not overfill crankcase. This will cause oil aeration and loss of oil pressure.

Filter

Normal driving—The oil filter should be replaced with a new filter at every second engine oil change. If mileage is less than 7,500 miles (12 000 km) each 12 months, replace oil filter at each oil change.

Severe service—For severe operating conditions as outlined above, the oil filter should be replaced at every second oil change.

Disposing of Used Engine Oil

Care should be taken in disposing of the used engine oil from your vehicle. Used oil, indiscriminately discarded, can present a problem to the environment. Contact your dealer, service station, where used oil can be safely discarded in your area.

COOLING SYSTEM

Cooling System—Inspection

Coolant protection checks should be made every 12 months (prior to the onset of freezing weather, where

applicable). If coolant is dirty or rusty in appearance, the system should be drained, flushed and refilled with fresh coolant.

Check radiator cap for proper vacuum sealing and operation. Use caution when removing the radiator cap to avoid contact with hot coolant or steam. Place a cloth over the cap, turn to the first stop, (do not press down), pause to allow pressure to release through the overflow tube, then press down and turn counterclockwise to remove cap. Check face of radiator and air conditioning condenser for any accumulation of bugs, leaves, etc. Check reserve tank tubing for connection at reserve tank and radiator. Inspect entire system for leaks.

The cooling system has a 44/56 solution of antifreeze and water from the factory. This is the recommended solution for most operating temperatures and provides good corrosion protection.

Failure to follow antifreeze concentration and replacement recommendations or failure to use antifreeze formulated to prevent corrosion of all cooling system metals, may result in radiator plugging engine overheating or cooling system leaks, such as at core hole plugs, resulting in loss of coolant. Refer to Group 7, Cooling System for additional information.

WARNING: TAKE CARE TO AVOID THE RADIATOR COOLING FAN WHENEVER THE VEHICLE HOOD IS RAISED.

Radiator Cap

The radiator cap must be fully tightened in order to provide a good seal with the radiator filler neck, to prevent loss of coolant and to insure that coolant will return to the radiator from the coolant reserve tank. The vent valve and its seat can become contaminated with coolant sediment etc. If system will not go under pressure or the coolant reserve system tank gains coolant abnormally, or if the top radiator hose collapses on cool-down, then the valve and seat should be carefully cleaned.

Cooling System—Drain, Flush, and Refill

After three (3) years of 84 000 kilometers (52,500 miles) and every two (2) years of 48 000 kilometers (30,000 miles) thereafter, the system should be drained, flushed, and refilled. If the solution is dirty or rusty or contains a considerable amount of sediment, clean and flush with a reliable cooling system cleaner.

Follow with a thorough rinsing to remove all deposits and chemicals. Discard old antifreeze solution.

To Drain System—Open radiator drain cock. Remove the radiator cap only after the reserve tank stops draining. This method eliminates the need to siphon coolant from the reserve tank, and provides a good means of determining whether the radiator pres-

sure cap and hose connection to the coolant reserve system tank provides an air tight seal.

To Fill System—Close the drain cock. Add recommended coolant to the radiator until it is completely filled. Use only a high quality ethylene, base antifreeze coolant with silicate inhibitor, such as MOPAR P/N 4267020, Prestone II, PEAK, or antifreezes containing Alugard 340-2 inhibitor system. Start engine and add coolant to the radiator as necessary. Install the radiator cap and add coolant to the reserve tank until filled to a level between the marks. Maintain this level with the engine at normal operating temperature. If significant air has been trapped during filling, it may be necessary to warm up, then cool down the engine approximately three times to expel all air, while maintaining coolant at the proper level.

ENGINE AIR CLEANER

The engine air cleaner should be replaced as described in proper maintenance schedule. When the vehicle is frequently operated in dusty conditions the air cleaner should be replaced and the wrapper cleaned (5.9L Engine) as required. See Group 25, for more information.

To Service The Air Cleaner

Remove cleaner assembly (Fig. 4), remove paper element. Clean filter element by blowing dirt out gently with compressed air hose (Fig. 5). Direct air from inside out, and keep nozzle two inches away from element to avoid damage. If the filter element is saturated with oil for more than 1/2 its circumference

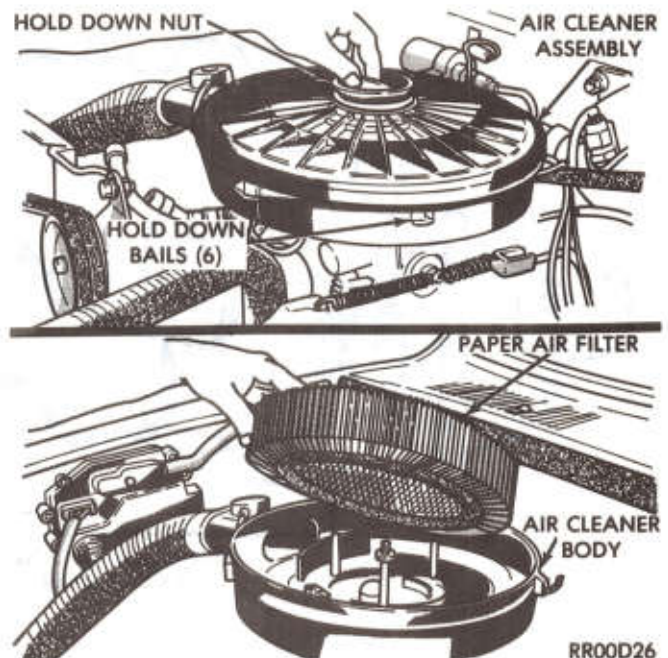


Fig. 4—Engine Air Cleaner Assembly (Typical)

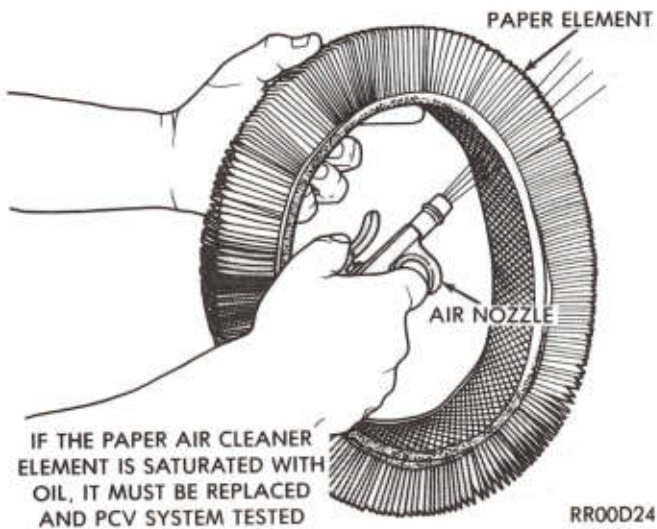


Fig. 5—Cleaning Filter Element

replace the filter element and wrapper assembly and check the rest of the crankcase ventilating system for proper functioning.

Do not tap or immerse paper element in liquid.

On vehicles equipped with a heated air system do not immerse temperature sensor (located in air cleaner housing) in cleaning solution.

Wash the cleaner cover and body with cleaning solvent; and wipe dry.

Replace paper element (and wrapper—if equipped)

and secure firmly. Replace cleaner assembly on engine.

Vehicles operating in dusty areas will require more frequent attention.

CARBURETOR CHOKE VALVE SHAFT 5.9L ENGINE

To prevent the choke and other carburetor linkage from sticking due to gum deposits on the shaft, spray MOPAR Combustion Chamber Conditioner Part Number 4318001, or equivalent solvent onto the choke shaft where it passes through the air horn. Move choke blade back and forth to distribute the solvent. This service should be performed at the recommended time or mileage shown on the appropriate "Scheduled" maintenance chart. Apply solvent to the fast idle cam and pivot pin to remove dirt, oil and other deposits that may have collected which could cause sticking or erratic motion. (Fig. 6).

THROTTLE CONTROL LINKAGE

All transmission linkage pivot pin areas except ball joint type (Fig. 7), should be cleaned of dust and dirt and relubricated every second oil change with Multi-purpose Grease NLGI Grade 2 E.P. **DO NOT LUBRICATE CARBURETOR LINKAGE, THROTTLE LINKAGE BALL JOINTS, THROTTLE CONTROL CABLES, OR TRANSMISSION KICKDOWN CABLES.**

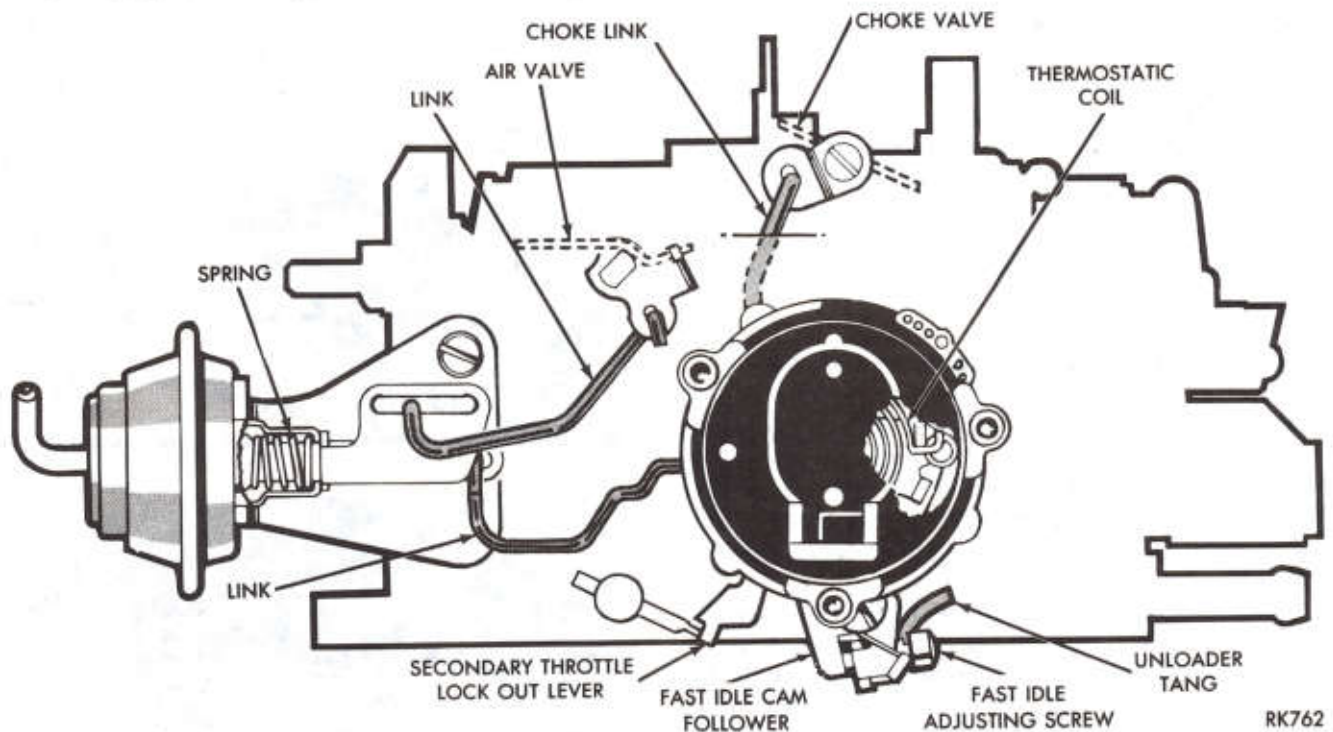


Fig. 6—Apply Solvent to Choke Shaft Secondary Linking and Fast Idle Cam (5.9L Engine)

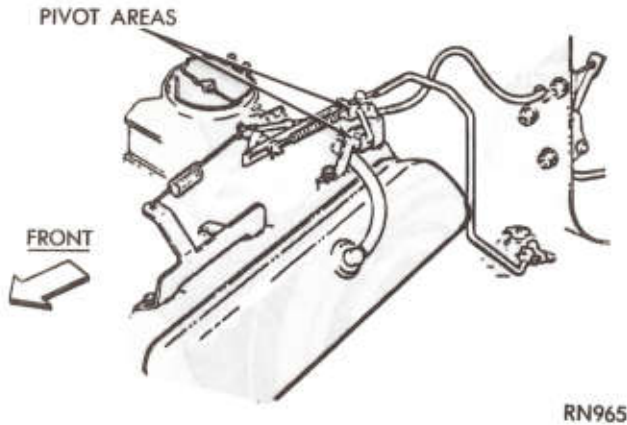


Fig. 7—Accelerator Linkage Pivot Areas
MANIFOLD HEAT CONTROL VALVE 5.9L ENGINE

Service valve, depending on duty cycle, and schedule, as recommended on the appropriate "Scheduled" maintenance chart.

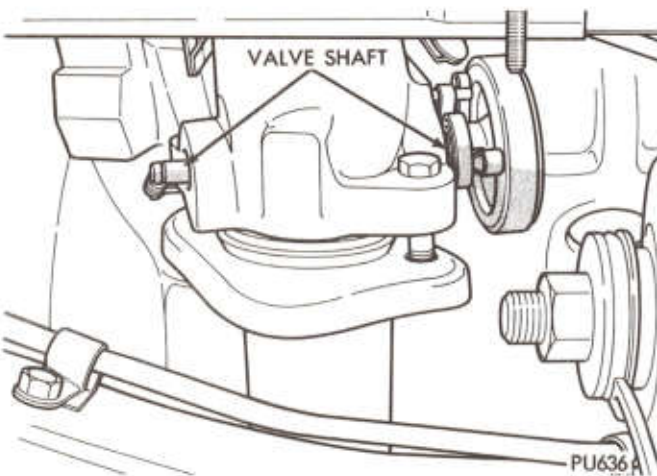


Fig. 8—Manifold Heat Control Valve

Service

Spray a small amount of MOPAR Manifold Heat Control Valve Solvent, Part Number 4318039 or equivalent, to each end of the shaft at the bearings (Fig. 8). Work valve back and forth a few times to make sure the lead deposits have been dissolved.

AIR INJECTION SYSTEM

All valves and switches in the Air Injection System and the air pump should be checked for proper operation and replaced if necessary. Inspect the check valve tubing for corrosion and replace if excessive corrosion is evident.

CRANKCASE VENTILATION SYSTEM

All models with gasoline operated engines are equipped with a closed crankcase ventilation system

designed to eliminate emission of residual fumes and vapors from the crankcase by directing these fumes back through the engine combustion chambers.

This system consists of a crankcase PCV valve mounted on the cylinder head cover with a hose extending from the valve to the base of the carburetor. A closed crankcase inlet air filter with a hose connecting it to the carburetor air cleaner housing provides the source of air for the system.

Ventilation System Operation (Fig. 9)

The ventilation system operates by manifold vacuum. Air is drawn from the air cleaner, through the air cleaner hose to the crankcase inlet air cleaner, through the crankcase inlet air cleaner and into the crankcase. The air then is circulated through the engine and drawn out through the PCV valve, through the PCV valve hose and into a passage in the carburetor throttle body, becoming part of the calibrated air/fuel mixture drawn into the combustion chamber and is then burned and expelled with the exhaust gases.

Frequency of Service

The crankcase ventilation system must be kept clean to maintain good engine performance and durability.

Periodic service is required to remove combustion products from the valve, hoses, and carburetor passages. The ventilation system consisting of: the crankcase inlet air cleaner; PCV valve, hoses and passages, and carburetor air cleaner. These components should be inspected and serviced as indicated at the recommended interval shown on the appropriate "Scheduled" maintenance chart. If a vehicle is used extensively for short trips with frequent idling, the crankcase ventilation system may require servicing more frequently.

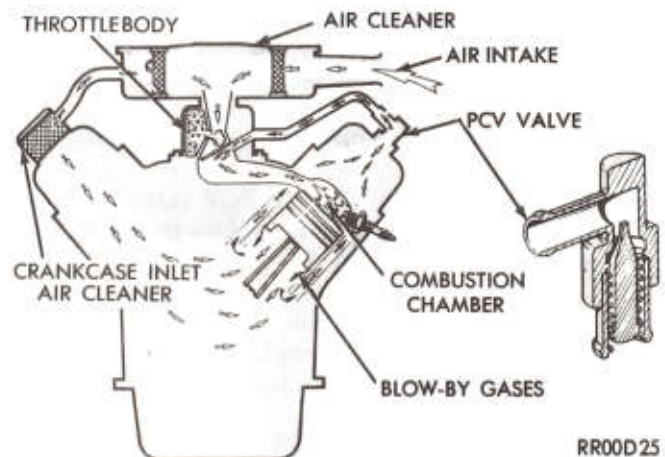


Fig. 9—Crankcase Ventilation System Operation (Typical)

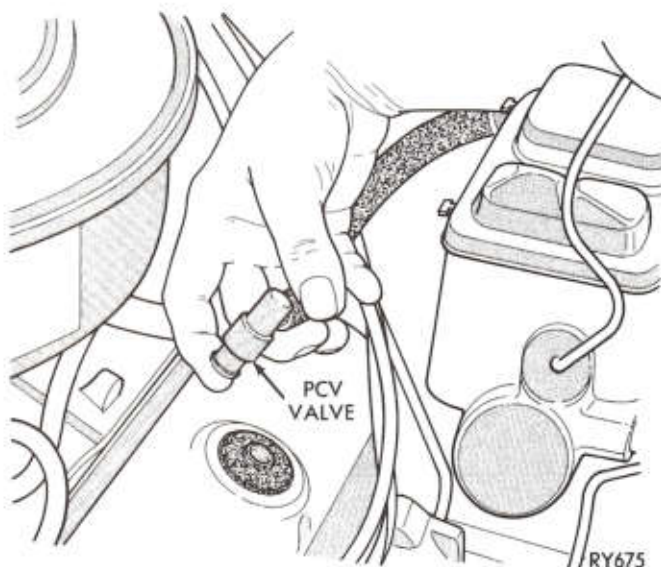


Fig. 10—Check Vacuum at PCV Valve

Inspection and Service Procedure

- (1) With engine idling:

- (a) Remove PCV valve

If the valve is not plugged, a hissing noise will be heard as air passes through the valve, and a strong vacuum should be felt when a finger is placed over the valve inlet. (Fig. 10).

(b) Reinstall the PCV valve, then remove the crankcase inlet tube from the air cleaner assembly and loosely hold a piece of paper over the open end of the tube. After allowing about a minute for the crankcase pressure to reduce, the paper should be sucked against the opening with a noticeable amount of force.

- (2) With engine stopped:

Remove PCV valve and shake. A clicking noise should be heard to indicate that the valve mechanism is free.

(3) If the crankcase ventilation system meets the tests in (1) and (2) above, no further service is required; if not, the PCV valve should be replaced and the system rechecked. Install a new Mopar PCV Valve, or equivalent. **Do not attempt to clean the old PCV valve!**

(4) If test (1b) fails when a new PCV valve has been installed, it will be necessary to replace the PCV hose and clean the PCV hose intake port.

(5) Clean the crankcase inlet air filter. See "Crankcase Inlet Air Filter" this Group.

(6) Clean or replace the engine air cleaner. See "Engine Air Cleaner", this Group.

CRANKCASE INLET AIR FILTER

The crankcase inlet air filter is mounted on the cylinder head cover and is part of the "crankcase ventilation system".

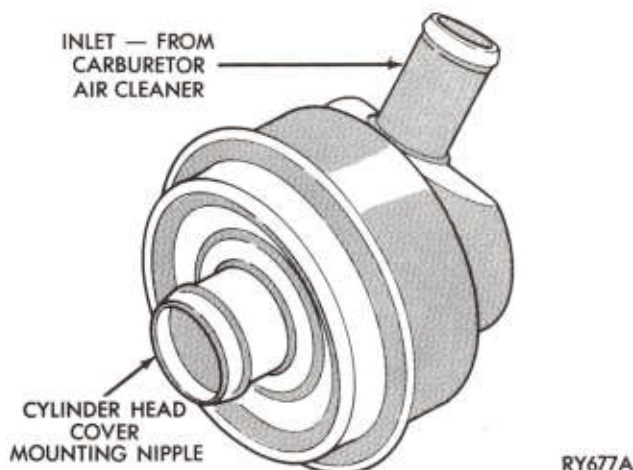


Fig. 11—Crankcase Inlet Air Filter

Clean and lubricate the crankcase inlet air cleaner at time or mileage interval shown on the "Scheduled" maintenance chart.

Service

Disconnect the hoses from the crankcase inlet air filter (Fig. 11). Remove the crankcase inlet air filter and wash it thoroughly in kerosene or similar solvent. Lubricate or wet filter, by inverting the crankcase inlet air filter and filling with SAE 30 engine oil. Position the air filter to allow excess oil to drain thoroughly through the vent nipple located on the top of the air filter.

More frequent service may be required for vehicles used in short run, stop and go, or extended engine idle service.

FUEL SYSTEM

Use gasolines having a minimum octane rating of 87, (R + M)/2.

Unleaded gasolines only must be used in vehicles equipped with catalyst emission control systems. All vehicles, so equipped, have labels located on the instrument panel and adjacent to the fuel filler cap or door that state, "UNLEADED FUEL ONLY." These vehicles also have fuel filler tubes specially designed to accept the smaller diameter unleaded gasoline dispensing nozzles only.

The exhaust emission system for your vehicle is designed to meet all emission regulation while, at the same time, providing excellent fuel economy. **Catalyst systems requires that only unleaded gasoline be used.** Use of leaded fuel will not only destroy the effectiveness of the catalytic converter used to reduce exhaust emissions but will also make part of the fuel consumption.

Vehicles not equipped with catalyst emission control systems may be operated on either leaded or

unleaded gasolines having the same octane rating described.

Gasolines Containing Alcohol

Some gasolines sold at service stations contain alcohol, although they may not be so identified. Use of fuels containing alcohol is not recommended, unless the nature of the blend can be determined as being satisfactory.

GASOHOL—a mixture of 10% ethanol (grain alcohol) and 90% unleaded gasoline may be used in your vehicle. If driveability problems are experienced as a result of using GASOHOL, it is recommended that the vehicle be operated on gasoline.

METHANOL—do not use gasolines containing methanol (wood alcohol). Use of this type of alcohol can result in vehicle performance deterioration and damage critical parts in the fuel pump, carburetor, and other fuel system components. Fuel system damage and vehicle performance problems, resulting from the use of gasolines containing methanol, may not be covered by the new vehicle warranty.

Materials Added to Fuel

Indiscriminate use of fuel system cleaning agents should be avoided. Many of these materials intended for gum and varnish removal may contain highly active solvents or similar ingredients that can be harmful to gasket and diaphragm materials used in fuel system component parts.

Fuel Filter

Plugging of a fuel filter can be caused by contaminants in the fuel. This can limit the speed at which a vehicle can be driven and cause hard starting. If these conditions occur. The filter should be replaced.

VACUUM OPERATED COMPONENTS

Inspect all vacuum operated, emission related, components to insure components are not cracked or broken. Replace component(s) as necessary.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

The EGR valve and EGR tube (if so equipped) at the mileage or time interval specified in the Maintenance Schedules. For additional information refer to Group 25, Emission Control System.

IGNITION CABLES, DISTRIBUTOR CAP AND ROTOR

Replace the ignition cables, distributor cap and rotor at the mileage interval indicated on the Maintenance Schedule. Check the distributor for excessive

wear and proper component clearances. Replace if necessary.

IDLE ADJUSTMENT (PROPANE METHOD)

To adjust the carburetor idle mixture (5.9L engine), refer to Group 14, Fuel System.

OXYGEN (O₂) SENSOR

Replace the oxygen sensor at the mileage and time interval specified in the Maintenance Schedule. Refer to Group 25, Emission Control System for additional information.

SPARK PLUGS

Replace the spark plugs at the mileage or time interval specified in the Maintenance Schedule. Refer to Group 8D, and the Operating Instructions and Product Information Manual provided with the vehicle for additional information.

IGNITION TIMING

Check and adjust the ignition timing according to specification shown on the Engine Emission Control Information Label, located in the engine compartment.

BATTERY

All vehicles are equipped with maintenance free batteries (see Specifications for application). Maintenance-free batteries (Fig. 12) are as the name applies,

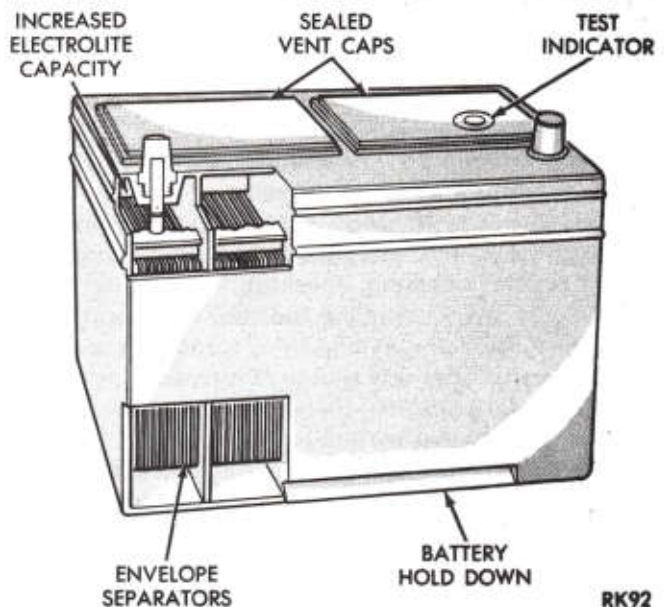


Fig. 12—Maintenance Free Battery

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totally maintenance free and has no removable battery cell caps. **Water never needs to be added to the maintenance-free battery.** Battery is completely sealed, except for small vent holes in the cover. These vent holes allow what small amount of gases are produced in the battery to escape. Special chemical composition inside of battery reduces production of gas to an extremely small amount at normal charging voltages. Battery contains a **visual test indicator** which signals when an adequate charge level exists **green indicator**, when charging is required **red** or **black**, or when replacement is required **yellow**. Battery is of polypropylene construction.

ALTERNATOR

Refer to the maintenance schedule and Group 8C, "Alternator" for more information.

VACUUM OPERATED EMISSION CONTROL COMPONENTS

Refer to Group 25, Emission Control System for more information.

RUBBER AND PLASTIC COMPONENTS INSPECTION

Variables such as type of vehicle service, geographic area of vehicle operation, and length of exposure time to heat and contaminants are factors affecting life of rubber and plastic components. To provide best vehicle performance and avoid adverse effect on component life, it is recommended that the following components be inspected when performing other underhood services. **Components should be replaced immediately if there is any evidence of degradation that could result in failure.**

Hoses (Except Emission Hoses)

Refer to Group 25, "Emissions Control Systems" for inspection of emission hoses.

Inspect surface of hoses and nylon tubing for evidence of heat and mechanical damage. Hard and brittle rubber, cracking, checking, tears, cuts, abrasion, and excessive swelling indicate deterioration of the rubber. Hose and nylon tubing located close to the exhaust manifold or any source of intense heat should receive special attention. Be certain that nylon tubing in these areas is not melted or collapsed.

Inspect hose routing to insure hose does not come in contact with any heat source or moving component which will cause heat damage or mechanical wear.

Inspect all hose connections such as clamps and couplings to make sure they are secure and no leaks

are present. In many instances, fluids such as oil, power steering fluid, and brake fluid are used during assembly of hoses to couplings. Therefore, oil wetness at the hose-coupling area is not necessarily an indication of leakage. Actual dripping of hot fluid when systems are under pressure (during vehicle operation), should be noted before hose is replaced based on leakage.

Drive Belts

At the mileage indicated in the maintenance chart, all belts should be checked for condition and proper tension. Improper belt tension can cause belt slippage and failure.

Belts should be inspected for evidence of cuts, cracks, or glazing, and replaced if there is indication of damage which could result in belt failure. If adjustment is required, the belts must be adjusted according to the specifications and procedures described in Group 7, Cooling. Special tools are required to properly measure tension and to restore belt tension to factory specifications.

Engine Mounts

Inspect the connecting fasteners between the block and the engine mount bracket and those holding the mount to the frame for correct torque as specified in Group 9, Engine. The rubber in the mount should be inspected for excessive softening, swelling, and/or gumminess caused by oil and/or gasoline contamination. Slight surface deterioration and wear at the ends will not adversely affect performance. If, however, excessive engine movement, rubber softening or swelling, or noise caused by metal-to-metal contact is observed, the engine mount assembly should be replaced.

CAUTION: Avoid continuous contamination with oil or gasoline. Such contamination will result in reduced engine mount life.

Exhaust System Rubber Isolator and Hanger

Inspect surface for rubber-to-metal separation or deep cracks. Slight cracking due to weathering and ozone does not adversely affect performance. If, however, excessively deep, localized cracks are present, or any part of the exhaust system abnormally contacts the underbody or underbody hardware, the isolator and/or hanger should be adjusted or replaced.

Ignition Wiring

The ignition cables should be kept clean and properly connected. Terminals should be fully seated and the nipple assemblies should not be removed from the distributor or coil towers.

AIR CONDITIONING COMPRESSOR

The lubricant level in the air conditioning compressor should be checked if there are signs that oil was lost (Oily shaft seal area, oil covered fittings etc.) Loss of oil usually accompanies loss of refrigerant charge.

The presence of gas bubbles (white foam) as viewed through the filter drier sight glass, while the system is in operation, indicates some loss of refrigerant charge has occurred.

For compressor oil level check or recharging system, see Group 24, Heaters and Air Conditioning.

DRIVETRAIN

INDEX

	Page		Page
Axle	23	Front Axle Universal Joints	24
Automatic Transmission	20	Manual Transmission	20
Clutch and Brake Linkage	19	Propeller Shaft Universal Joints	24
Clutch Master Cylinder	19	Transfer Case	22

CLUTCH AND BRAKE LINKAGE

If the clutch and brake pedal assembly should start to squeak or grunt, the pivot bushing should be lubricated (Fig. 1) with a multipurpose (NLGI-grade 2) grease, MOPAR Multi-Purpose Lubricant, PN-4318063 or an equivalent that meets these requirements are recommended.

CLUTCH MASTER CYLINDER

The clutch master cylinder fluid level should be

periodically inspected when other under hood service is performed. The fluid level in the reservoir should be up to the bottom of the lid retaining collar. (Fig. 1). If the fluid level should become low, locate and correct any possible leaks and refill the reservoir with clean, moisture free brake fluid conforming to DOT 3, (MUSS 116) standard only. MOPAR Brake Fluid or an equivalent that meets these requirements are recommended to provide the best clutch performance.

CAUTION: Do not allow any petroleum base fluids to contaminate the clutch hydraulic system, seal damage will result.

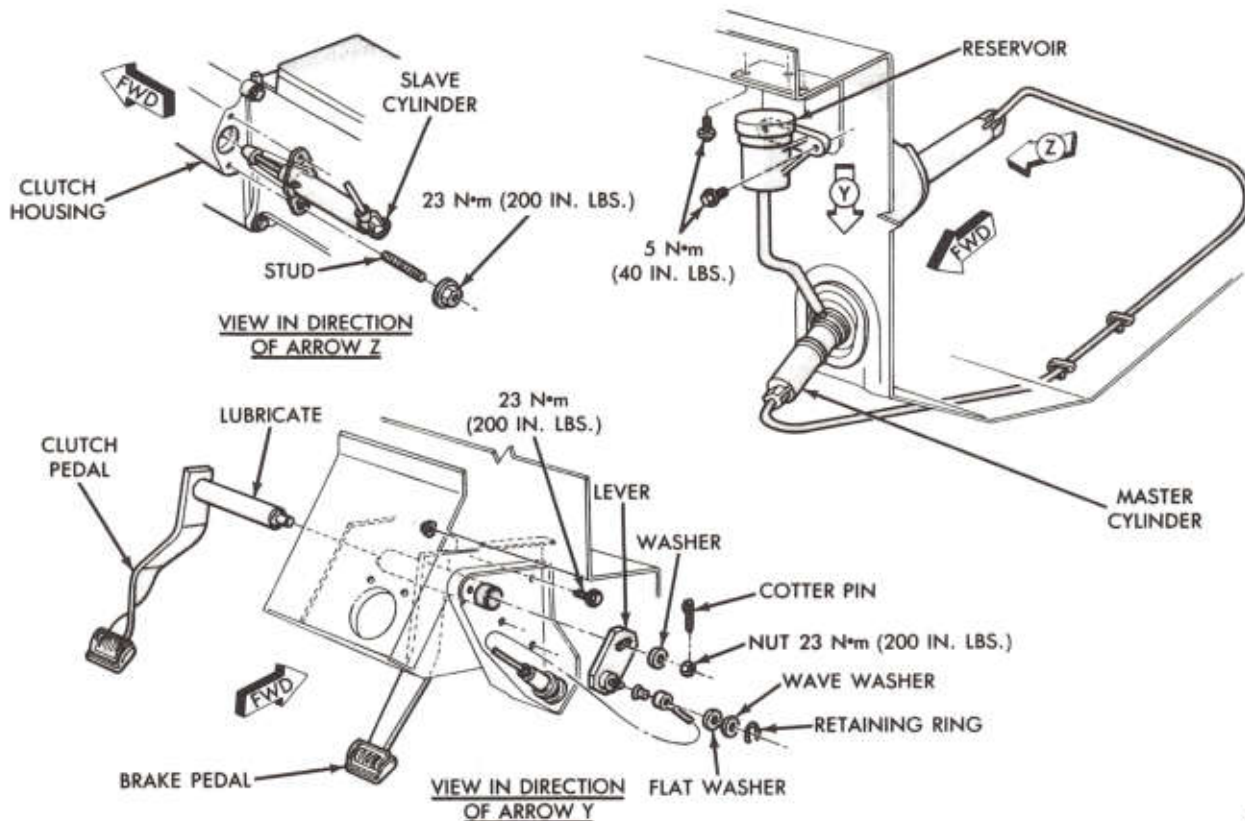


Fig. 1—Clutch System Maintenance

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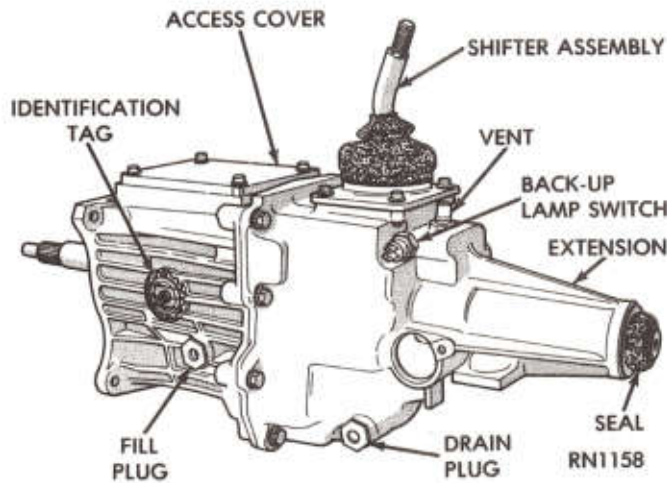


Fig. 2—NP2500 Transmission Drain and Refill

MANUAL TRANSMISSION NP2500 OVERDRIVE 5-SPEED

The NP2500 overdrive 5-speed should be inspected for leakage and proper oil level whenever general Maintenance is performed under the vehicle. To check oil level remove the filler plug (Fig. 2) and bring the oil level to the bottom of the filler hole. The NP2500 transmission is filled with SAE 10W-30 engine oil at the factory. If it becomes necessary to add oil or when changing the oil in this transmission use only SAE 10W-30 Engine Oil, conforming to the requirement of the API Classification FOR SERVICE SF/CD OR SF/CC.

Drain and Refill

The NP2500 overdrive 5-speed transmission should be drained and refilled at the following intervals.

Light Duty Cycle, 37,000 miles (60 000 km)
Heavy Duty Cycle 36,000 miles (58 000 km)
Severe Service 18,000 miles (29 000 km)

NP435 OVERDRIVE 4-SPEED

Remove filler plug and check oil level whenever the vehicle is serviced for other reasons. If the level of the lubricant is below the bottom of the filler hole, enough lubricant should be added to bring the level up to the bottom of the filler hole (Fig. 3).

Drain and Refill

Transmission should be drained and refilled prior to anticipated temperature changes or at the following intervals, whichever occurs first:

Normal Service—Every 36,000 miles (58 000 km)
("Heavy Duty Cycle")
Every 37,500 miles (60 000 km)
("Light duty Cycle")
Severe Service—Every 18,000 miles (29 000 km)

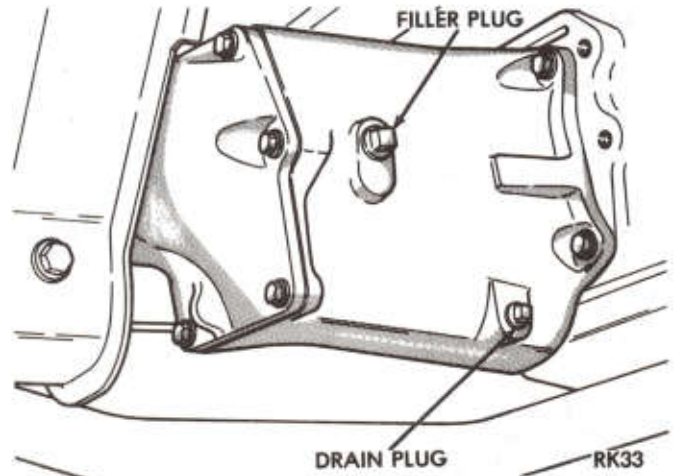


Fig. 3—Transmission Filler and Drain Plugs

Lubricant Selection - Overdrive 4

Multipurpose gear oils meeting API specifications GL-5 or engine oils labeled for API service SF/CC or SF/CD are recommended.

If anticipated ambient Temperature is

Above +90°F (32°C)	Use SAE 140
As low as -10°F (-23°C)	Use SAE 90
Below -10°F (-23°C)	Use SAE 80
SF/CC or SF/CD Engine Oil	
Above +32°F (0°C)	Use SAE 50
Below +32°F (0°C)	Use SAE 30

Gearshift Linkage (Manual Transmission)

The gearshift control mechanism should be lubricated every 22,500 miles (36 000 km) or every two years whichever occurs first, or more frequently if

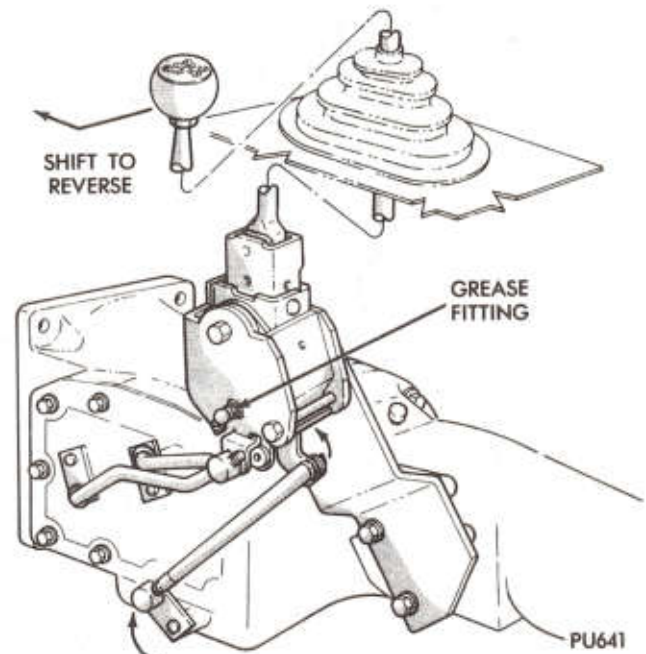


Fig. 4—Four-Speed Shift Mechanism

high shift effort or noise (mechanism rattling) is apparent.

The four-speed gearshift control mechanism is equipped with a grease fitting located on the left side of the mechanism (Fig. 4), accessible from the underside of the vehicle. Using a high pressure grease gun, apply Multipurpose Grease, NLGI, Grade 2 E.P. into the control mechanism until the grease is visible on the operating levers. **(Vehicle must be in reverse gear position, with the engine OFF, when lubricating this mechanism).**

Shifter Mechanism Boot

Inspect both automatic and manual shifter boots for stone or heat damage. Replace, if necessary.

AUTOMATIC TRANSMISSION

Lubricant Selection

It is important proper lubricant is used in the transmission. Mopar ATF plus (Automatic Transmission Fluid Type 7176) should be used to aid in assuring optimum transmission performance. Fluids of the type labeled Dextron II automatic transmission fluid should be used only if the recommended fluid is not available.

Fluid Level Check

The fluid level in the automatic transmission should be checked when performing other underhood services. Operation with an improper fluid level will greatly reduce the life of the transmission and of the fluid.

When the fluid level is checked, especially on vehicles operated under conditions of severe service, the condition of the fluid should be observed. If severe darkening of the fluid, accompanied by a strong odor is noted, the fluid and filter should be changed and the bands adjusted. A physical change in the fluid, such as this, may be the result of overheating, such as is possible in severe service or if the vehicle is equipped with a nonfactory installed air conditioning unit.

Procedure for Checking Fluid Level

To properly check the automatic transmission fluid level, the following procedure must be used:

- (1) Vehicle must be on level ground.
- (2) Engine should be running at curb idle speed.
- (3) Apply parking brake fully.
- (4) Place gear selector momentarily in each gear position, ending with the lever in N (neutral).
- (5) Remove dipstick, wipe clean, and determine if fluid is hot or warm. Hot fluid is approximately 180°F (–82°C) which is the normal operating temperature after the vehicle has been driven at least 15 miles.

The fluid cannot comfortably be held between the finger tips. Warm is when fluid is between 85-125°F (29°–52°C).

(6) Wipe dipstick clean, reinsert until cap seals, remove, and note reading.

(a) If the fluid is hot, the reading should be in the cross hatched area marked OK.

(b) If the fluid is warm, the fluid level should be between the two dimples.

If the fluid level checks low, add sufficient fluid to bring the level to within the marks indicated for the appropriate temperature.

To prevent dirt and water from entering the transmission after checking or replenishing fluid, make certain that the dipstick cap is reseated properly.

CAUTION: Do not overfill the transmission. An electronic fluid level sensor, available on some vehicles, provides a convenient means of checking transmission fluid level. Following the procedure outlined above, allow the engine to idle and observe the transmission warning lamp for 30 seconds. If the lamp remains off, it is not necessary to proceed further. If the lamp glows, fluid level should be checked manually.

Use of Special Additives

Chrysler Motors does not recommend the addition of any additives to the transmission fluids listed in the "Lubricant Selection" section. Exceptions to this policy are the uses of special dyes to aid in detecting fluid leaks.

The use of transmission sealers should be avoided since they may adversely affect seals.

Fluid, Filter Change and Adjustment Periods

Automatic transmission fluid and filter should be changed, and the bands adjusted as follows:

Type of Service	Required Services
Normal Usage	Every 37,500 miles (60 000 km)
Severe Usage (Described Below)	Every 12,000 miles (19 200 km)

Prolonged operation with heavy loading especially in hot weather. Off-the-highway operation. Towing trailers.

If the transmission is disassembled for any reason, the fluid and filter should be changed and the bands adjusted (See "Transmission," Group 21, for service procedures).

Draining

Trucks do not have a torque converter drain plug. No attempt should be made to drain the converter. Therefore, remove the transmission oil pan and allow transmission to drain completely. Clean oil pan. Use a new gasket when replacing oil pan. Install and

tighten oil pan. Tighten oil pan bolts to 150 inch pounds (17 N·m) torque.

Refilling

Pour approximately two quarts (1.9 liters) of Automatic Transmission Fluid (see "Lubricant Selection") into transmission filler tube. With engine idling in neutral, add enough fluid to bring the level between the dimple mark on indicator (approximately one pint) (0.5 liter). Allow engine to idle at least two minutes. Slowly shift transmission through all gears, pausing momentarily at each position, ending in the neutral position, and recheck. Add fluid to bring level between the dimple mark on the oil level indicator. Make sure oil level indicator properly sits on filler tube to prevent dirt from entering transmission.

When transmission fluid level is between the two dimples, and the temperature of the oil is 85°-125°F (29°-52°C), the fluid level will be at the crosshatched area marked "OK" when the transmission reaches normal operating temperature (approximately 180°F) (82°C).

TRANSFER CASE - NEW PROCESS 241 AND 205

	Truck Model	Capacity-Pints (Liters)
NP-241	AW100, W100-250	6.0 (2.8)
NP-205	W250-350	4.5 (2.2)

Fluid Level Check

With vehicle in level position remove filler plug (Fig. 5 or 6), and check fluid level. If level is below bottom of filler plug hole, add sufficient lubricant (see "Lubricant Selection") to restore level to bottom of filler hole.

Drain and Refill

The transfer case should be drained and refilled at

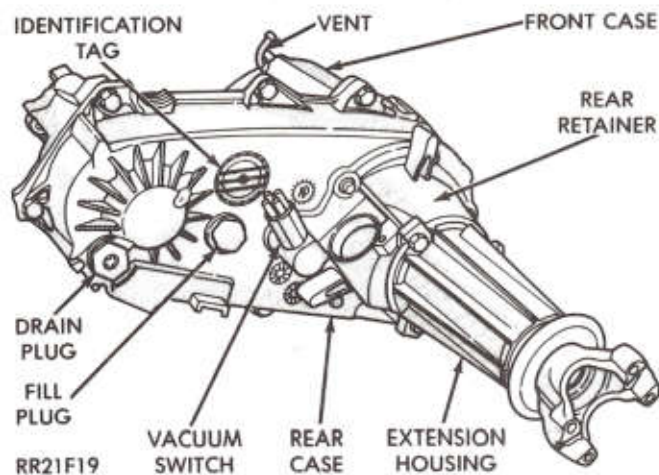


Fig. 5—NP241 Transfer Case Drain and Fill Locations

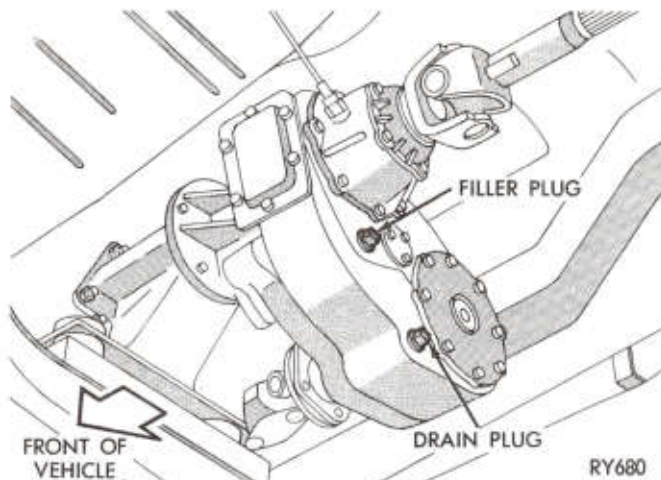


Fig. 6—NP205 Transfer Case Drain and Fill Locations

36,000 miles (58 000 km). ("Heavy Duty Cycle") or 37,500 miles (60 000 km) ("Light Duty Cycle").

Lubricant Selection — NP-241 Transfer Case

Fluids of the type labeled "Mopar ATF Plus" type 7176, or a fluid of the type labeled "DEXRON II" AFT or equivalent is recommended.

Lubricant Selection — NP-205 Transfer Case

Engine oils labeled for API Service "SF or SF/CC" may be used in this transfer case.

SAE Viscosity Grades — "SF" Engine Oil

Use SAE 30

Gear Shift Mechanism (Transfer Case) NP241 and NP205

The shift mechanism should be cleaned and relubricated as required to maintain ease of operation.

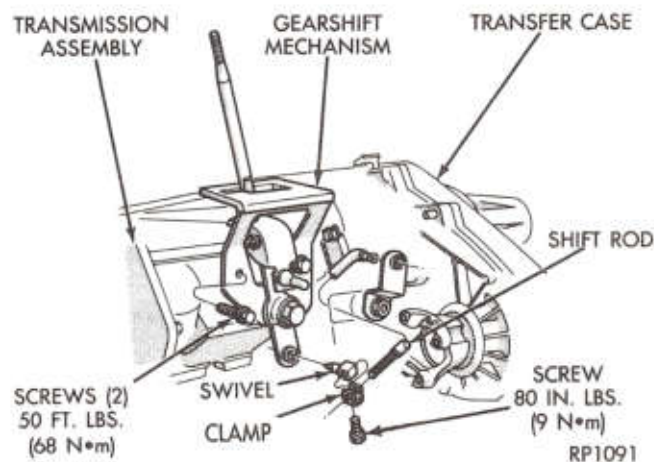


Fig. 7—Gearshift Mechanism Lubrication (NP241 Transfer Case)

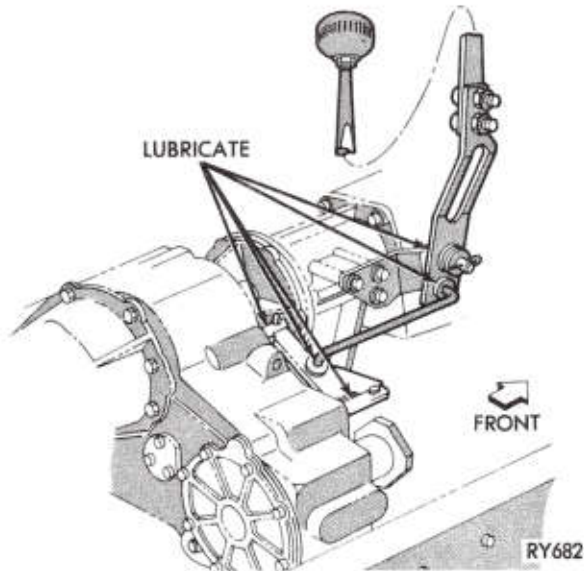


Fig. 8—Gearshift Mechanism Lubrication (NP205 Transfer Case)

When mechanism is cleaned relubricate pivot and sliding contact areas and shift linkage pivot ends with light engine oil (Figs. 7 and 8).

AXLES

Conventional Differential (Front and Rear)

All truck rear axles contain SAE 80W-90 multipurpose type gear lubricant when delivered from the factory.

Frequency of Oil Change

Chrysler Motors does not recommend regularly scheduled oil changes for axles in vehicles whose operation is classified as normal truck service, unless the lubricant has become contaminated with water or to provide the correct viscosity grade for the anticipated temperature range as follows:

Anticipated Temperature Range	Recommended SAE Grade
Above 90°F (32°C)	SAE 140, SAE 80W-140 SAE 85W-140
As low as -10° (-23°C)	SAE 90, SAE 80W-90 SAE 80W-140, SAE 85W-140
Below -10°F (-23°C)	SAE 75W, SAE 75W-90, SAE 80W, SAE 80W-140

The presence of water in the gear lubricant will result in corrosion and possible failure of differential components. Operation of the vehicle in water, as may be encountered in some off-highway, types of service will require draining and refilling the axle to avoid damage.

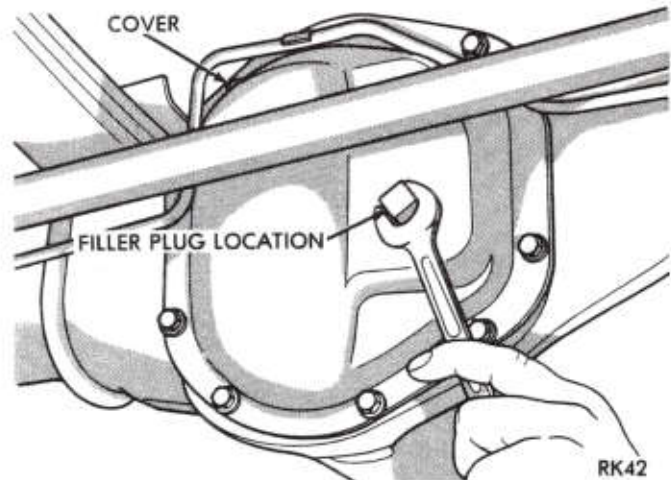


Fig. 9—Removing Filler Plug (Front Driving Axle)

Fluid Level Check

For normal service, periodic fluid level checks are not required. When the vehicle is serviced for other reasons, however, the exterior surfaces of the axle assembly should be inspected for evidence of gear oil leakage. Perform a fluid level check to confirm suspected leakage. With the vehicle supported on an axle or wheel type hoist or on the ground, maintain fluid level at the bottom of the filler plug opening. Confirmed leakage should be repaired as soon as possible.

Lubricant Selection

Chrysler Motors recommends that Multipurpose Gear Lubricant, as defined by the American Petroleum Institute GL-5, should be used in all rear axles with conventional differentials. MOPAR Hypoid Lubricant, Part Number 4318059, or equivalent, is an oil of this type and is recommended.

Filler Plugs — Type and Location

Front axles (Fig. 9) will have a metal screw in type filler plug. Rear axles will have either the screw in filler plug or a rubber "press in" type plug (Fig. 10).

Maintain fluid level to bottom of filler plug opening. Spicer 60 axles may have a rubber press-in type filler plug. When reinstalling rubber filler plug insure inner lip of filler plug is fully seated in cover.

The axles are not equipped with drain plugs. Remove old lubricant with a suction pump.

Rear Axle (Limited Slip Differential)

Model	Differential Type
D100, W100, AW100, AD100	Auburn Gear Cone—Clutch Type
D250-350, W250-350	Spicer Plate—Disc Type

For rear axles equipped with Auburn Gear Anti-Spin or Spicer Power-Loc or Trac-Loc Limited Slip

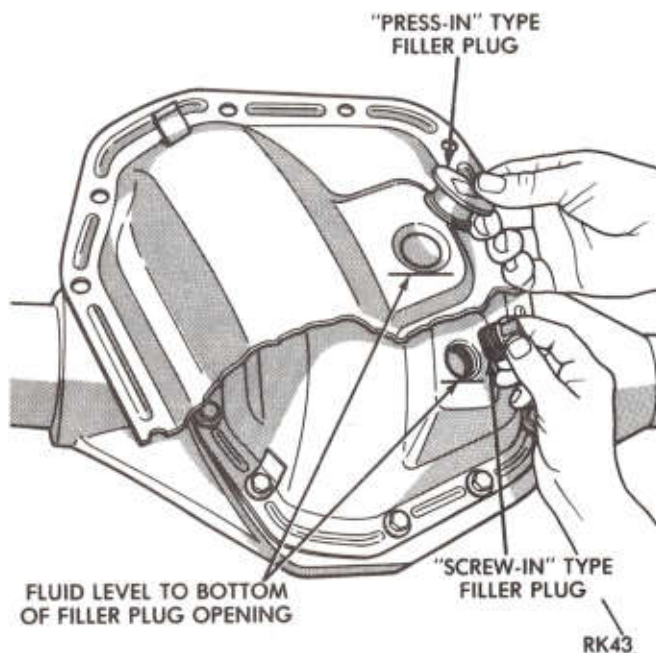


Fig. 10—Rear Axle Filler Plugs (Typical)

Differentials, follow the same inspection procedure and lubricant recommendations as outlined for axles with conventional differentials.

These limited slip differentials require the use of a friction control additive. Friction Modifier—Part No. 4318060. The addition of this special friction modifier additive is necessary to aid in preventing the occurrence of axle "chatter" in these units.

FRONT AXLE UNIVERSAL DRIVE JOINT AND PIVOT BEARINGS

Model W350 (With Spicer 60F Axle Only)

Every 6,000 miles (9 600 km) ("Heavy Duty Cycle") or 7,500 miles (12 000 km) ("Light Duty Cycle") lubricate the pivot bearings with a Multipurpose grease E.P. No. 2.

Do not use high pressure to fill front axle universal drive joints.

Models W100, W250, AW150 (With Spicer 44-8FD Axle)

The front axle universal joint and pivot bearings on these models with Spicer 44-8FD axle are permanently lubricated and do not require servicing.

PROPELLER SHAFT UNIVERSAL JOINTS

Propeller Shaft Universal Joints — Cross Type (Not Equipped with Grease Fittings)

Relubrication of cross type universal joints that do not have grease fittings is not required. The seals

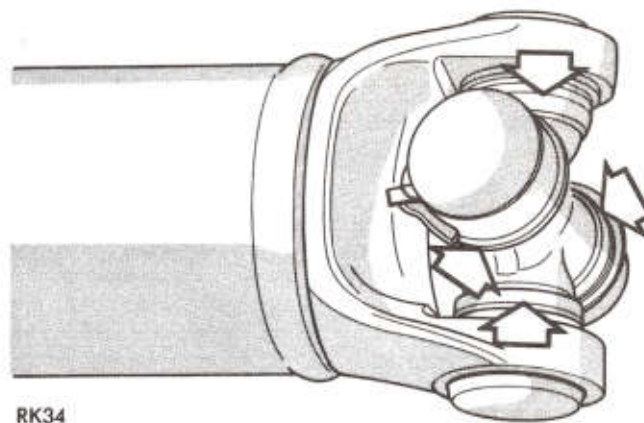


Fig. 11—Universal Joint Seal Inspection

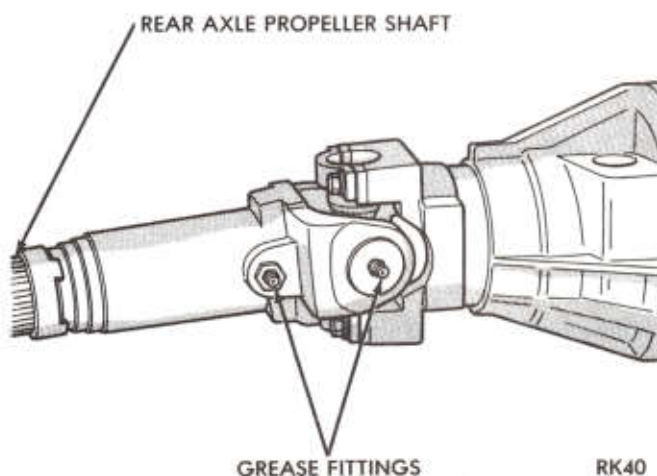


Fig. 12—Universal Joint and Slip Spline with Grease Fittings (Typical)

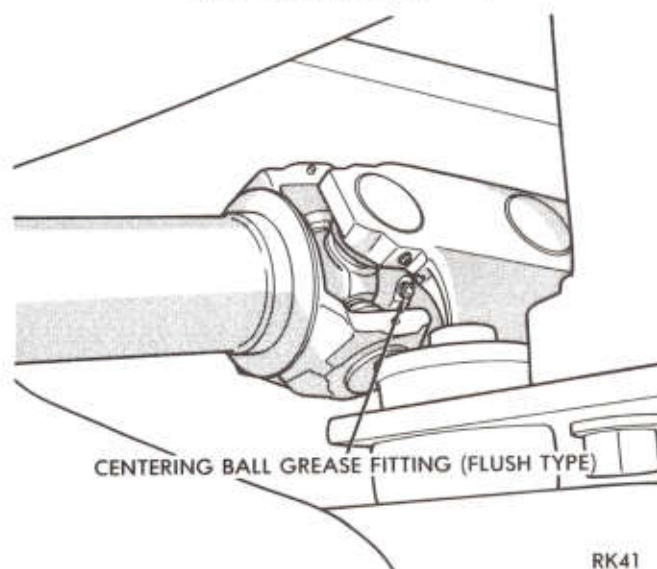


Fig. 13—Coolant Velocity Universal Joint Lubrication Points

should be inspected for external leaks or damage whenever the vehicle is serviced for other reasons (Fig. 11). If external leaks or damage is evident, the universal joint should be replaced.

Propeller Shaft Universal Joints and Slip Splines Equipped With Grease Fittings;

Constant Velocity Joint (Figs. 12 and 13)

Under normal driving conditions (highway type operation) lubricate every 7,500 miles (12 000 km) with MOPAR Multipurpose Lubricant Part Number 4318063, or equivalent, is a grease of this type and is recommended. If vehicle is operated in water, the universal joints should be lubricated daily.

CHASSIS AND BODY

INDEX

	Page		Page
Body Lubrication	28	Power Steering	26
Brakes	27	Speedometer Cable	29
Front Suspension Ball Joints	25	Steering Linkage	25
Front Wheel Bearings	26	Towing Recommendations	29
Headlights	29	Upper and Lower Control Arm Bushings	27
Manual Steering Gear	26	Vehicle Storage	31

STEERING LINKAGE

Whenever the vehicle is hoisted, all steering linkage joints (Fig. 1) should be thoroughly inspected for evidence of damage. Damaged seals should be replaced to prevent leakage or contamination of the grease. Steering linkage joints should be relubricated every 22,500 miles (36 000 km) or every two years whichever occurs first. When lubricating joints use only the special long life chassis grease such as MOPAR Multi-mileage Lubricant, Part Number 4318062, or equivalent.

FRONT SUSPENSION BALL JOINTS

Inspection

The front suspension ball joints (Fig. 1) should be

inspected whenever a vehicle is serviced for other reasons. Damaged seals should be replaced to prevent leakage or contamination of the grease.

Relubrication

Ball joints are semipermanently lubricated at the factory with a special grease. They should be regreased every 24,000 miles (39 000 km) ("Heavy Duty Cycle"), 22,500 miles (36 000 km) ("Light Duty Cycle") or every two years whichever occurs first. When lubricating ball joints, use only a special long life chassis grease intended for this purpose such as MOPAR Multi-mileage Lubricant, Part Number 4318062 or equivalent.

Front Suspension ball joints on vehicles used for off highway operation should be regreased at every engine oil change.

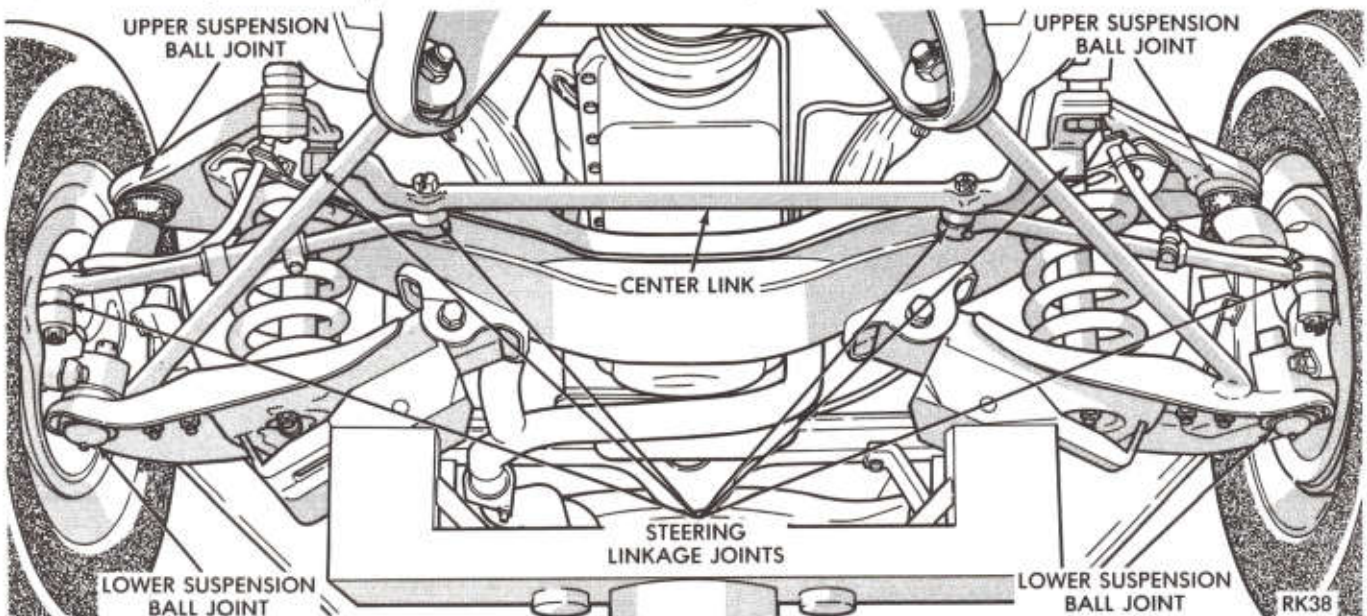


Fig. 1—Steering Linkage and Suspension Lubrication (Typical)

Procedure

Before relubrication clean the accumulated dirt and grease from the outside surface of the seal to permit complete inspection and wipe off the outside surface of the grease inlet area to avoid grease contamination.

Then fill and flush the joints with lubricant. Stop filling when grease begins to flow freely from the bleed areas at the base of the seal, or if the seal begins to balloon.

After relubrication wipe off any excess grease from exterior surfaces of ball joints and adjacent component surfaces.

MANUAL STEERING GEAR

The manual steering gear is permanently lubricated at the factory and periodic lubrication is not required.

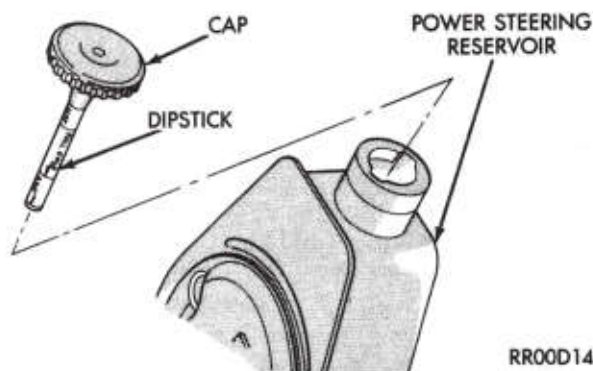


Fig. 2—Power Steering Pump (Typical)

POWER STEERING

WARNING: FLUID LEVEL SHOULD BE CHECKED WITH THE ENGINE OFF TO PREVENT PERSONAL INJURY FROM MOVING PARTS.

CAUTION: Add only automatic transmission fluid or hydroboost power steering fluid to power steering system, do not overfill.

The power steering fluid level should be checked at the power steering pump reservoir (Fig. 2) whenever the vehicle is serviced for other reasons. Before removing the reservoir cap, wipe the outside of the cap and reservoir with a cloth to remove dirt that can fall into the reservoir. Fluid level should be maintained to the proper level indicated on cap dipstick.

Only fluids specially formulated for minimum effect on rubber hoses should be used. MOPAR Power Steering Fluid, Part Number 4318055, or equivalent is recommended.

WHEEL BEARINGS (Fig. 3 and 4)**Inspection and Relubrication Procedure**

The condition of the grease in the hub and bearing

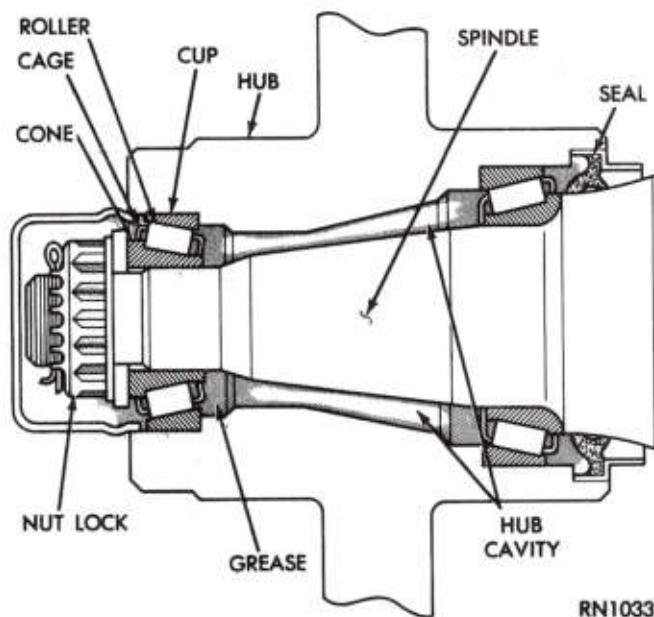


Fig. 3—Front Wheel Bearings 2-Wheel Drive Models

area on trucks equipped with either drum or disc brakes should be inspected at the intervals specified below. The presence of water, rust, or dirt may indicate the necessity of seal replacement. If it is found that the grease has become contaminated, is low in quantity, or if the vehicle has been operated under severe or dusty conditions, all of the lubricant should be thoroughly cleaned from the bearings, wheel hubs, dust cap, and/or covers. After cleaning, carefully check, for evidence of spalling of cups, rollers, and inner race of cone. Bearings should be replaced if any defects exist. Repack the bearings, apply grease to the hub, annulus area, and dust cap using **new** High

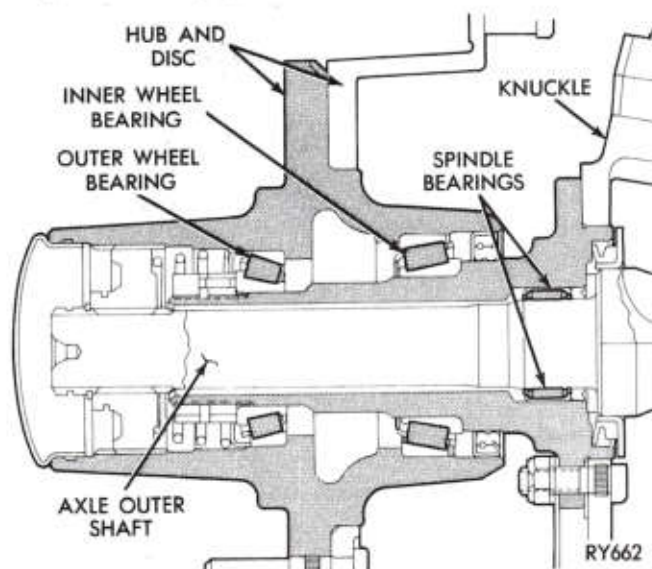


Fig. 4—Front Wheel and Spindle Bearings 4-Wheel Drive Models

Temperature Multipurpose Grease, E. P. MOPAR Front Wheel Bearing Grease Part Number 4318064, or equivalent is recommended. To avoid mixing different types of grease which may be incompatible, **NEVER ADD GREASE—RELUBRICATE COMPLETELY.**

Inspection and Relubrication Intervals

Front Wheel Bearings (and Spindle Bearings — 4 Wheel Drive Models)

Inspect the lubricant whenever the rotors are removed to inspect or service the brake system, but **at least at the following intervals.**

Spicer 44-8FD and 60F Front Driving Axle

Every 12,000 miles (19 000 km) ("Heavy Duty Cycle") or 15,000 miles (24 000 km) ("Light Duty Cycle").

All Except Spicer 44-8FD and 60F Front Driving Axle

Every 24,000 miles (39 000 km) ("Heavy Duty Cycle") or 22,500 (36 000 km) ("Light Duty Cycle").

Wheel bearings in vehicles equipped with Spicer 44-8FD or 60F front driving axles used for off-highway operation should be inspected every 1,000 miles (1 600 km). Bearings should be cleaned and repacked every day when vehicle is operated in deep mud or water.

The bearings should be cleaned or repacked as required and whenever the disc brake pads are replaced (Figs. 4 and 5).

Rear Wheel Bearings — 8-3/8" and 9-1/4" Chrysler Axles

These bearings are normally considered to be permanently lubricated. Cleaning and repacking is required only when axle shafts are removed or in cases of extreme water or dust contamination.

Rear Wheel Bearings — Dana 60

Clean and repack as required and whenever brake linings are replaced or brake drums resurfaced.

UPPER AND LOWER CONTROL ARM BUSHINGS

Early failure of upper and lower control arm bushings is exhibited by off center condition of inner metal in relation to outer metal. Total failure is evident by excessive movement within bushing and noise caused by metal-to-metal contact. Small cracks in outer non-confined rubber does not constitute failure.

Lower control arm bushings may be visually inspected by lifting the vehicle on a hoist and inspecting from underneath. Upper control arm bushing may be inspected by removing the front wheels. If failure exists, replace bushing. See Group 2, "Front Suspension".

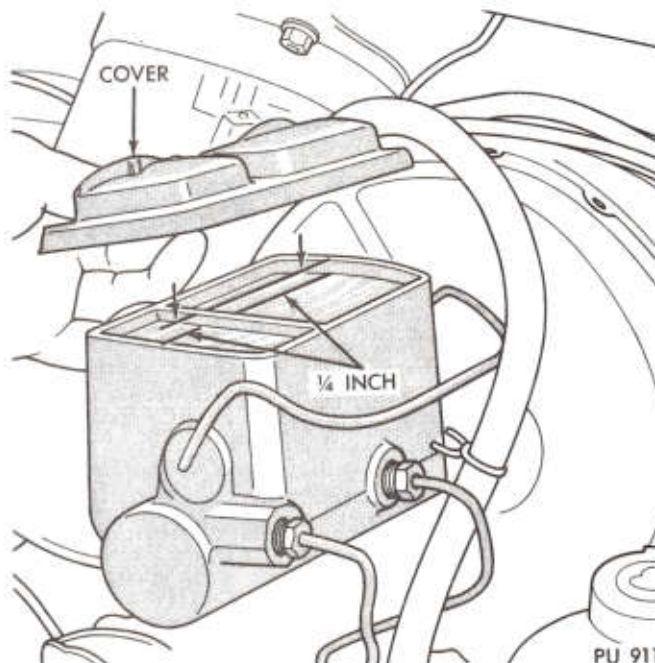


Fig. 5—Check Master Cylinder Fluid Level (Typical) BRAKES

The vehicle is equipped with disc brakes on the front and drum brakes on the rear wheels. Maintenance and Service on the brakes is covered under Group 5, "Brakes".

Master Cylinder

The fluid in the master cylinders should be checked when performing other underhood services (Fig. 5). If necessary, add fluid to bring level to the bottom of the split rings. With disc brakes, fluid level can be expected to fall as the brake pads wear. However, low fluid level may be caused by a leak, and a checkup may be needed. Only brake fluid conforming to DOT 3 should be used (DOT 3 is Federal, Department of Transportation specification). MOPAR Brake Fluid is a fluid of this quality and is recommended to provide best brake performance. Use of a brake fluid that may have a lower initial boiling point than specified by MVSS 116, DOT 3 unidentified as a specification, may result in sudden brake failure during hard, prolonged braking. Use only brake fluid that has been stored in a tightly closed container, to avoid contamination with with foreign matter or moisture.

CAUTION: Do not allow petroleum base fluids to contaminate the brake fluid—seal damage will result!

Parking Brake

Pivot and sliding contact areas indicated (Fig 6) should be lubricated as required to maintain ease of operation. Apply a film of smooth white body hard-

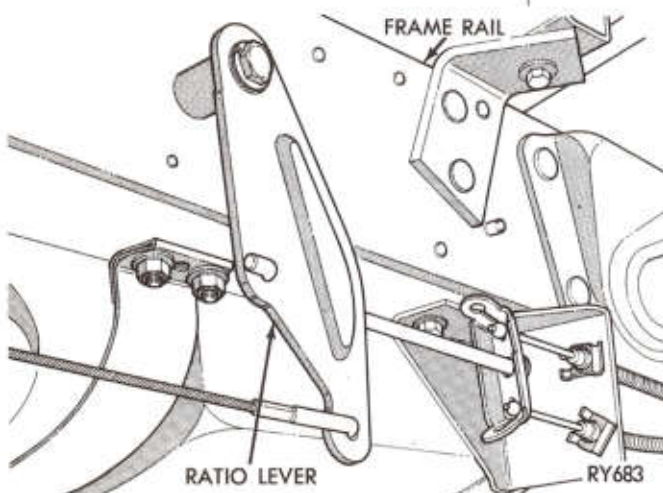


Fig. 6—Parking Brake Ratio Lever Lubrication

ware lubricant to sliding mechanism, such as MOPAR Spray White Lube (Part Number 4318066) or equivalent, and engine oil to ratio lever pivot areas.

Brake Hoses

Inspection of brake-hose and tubing should be included in all brake service operations and at each lubrication period. The hoses should be checked for:

(1) Correct length, severe surface cracking, pulling, scuffing or worn spots. **(Should the fabric casing of the hose be exposed by cracks or abrasions in the rubber hose cover, the hose should be replaced).** Eventual deterioration of the hose can take place with possible burst failure.

(2) Faulty installation to cause twisting, wheel tire or chassis interference.

BODY LUBRICATION

Body Mechanisms

Body and other operating mechanisms and linkages should be inspected, cleaned, and lubricated, as required, to maintain ease of operation and to provide protection against rust and wear. Prior to the application of any lubricant, the parts concerned should be wiped clean to remove dust and grit; after lubricating, excess oil or grease should be removed. Particular attention should also be given to hood latching components to insure proper function. When performing other underhood services, the hood latch, release mechanism, and safety catch should be cleaned and lubricated.

COMPONENT	SERVICE INTERVAL	LUBRICANT
Door Hinges	As Required	Engine Oil
Door Latches	As Required	Multi-Purpose Grease (Water Resistant)*
Hood Latch Release Mechanism & Safety Catch	When Performing Other Underhood Services	Multi-Purpose Grease NLGI Grade 2 EP
Hood Hinges	As Required	Engine Oil
Seat Regulator & Track Adjuster	As Required	Multi-Purpose Grease NLGI Grade 2 EP*
Tailgate Hinge (Quick Release Pins)	As Required	Multi-Purpose Grease NLGI Grade 2 EP*
Tailgate Check Arms	As Required	Engine Oil
Tailgate Latches	As Required	Smooth White Body Hardware Lubricant*
Tailgate Release Handle (Pivot & Slide Contact Surfaces)	As Required	Multi-Purpose Grease NLGI Grade 2 EP
Window System Components (Regulators, Tracks, Links, Channel Areas — Except Glass Run Weatherstrips and Felt Lubricator, if Equipped)	As Required	Smooth White Body Hardware Lubricant*
Lock Cylinders	Twice/Year	Lock Cylinder Lubricant*
Window Regulator Felt Tube Lubricator, if so Equipped	As Required	Engine Oil
Parking Brake Mechanism	As Required	Multi-Purpose Grease*

*Mopar Recommended Products

Mopar Multi-Mileage Lubricant, P/N 4318062
Mopar Spray White Lube, P/N 4318066

Mopar Wheel Bearing Grease (High Temperature), P/N 4318064
Mopar Lock Cylinder Lubricant, P/N 4318084

The external lock cylinders should be lubricated twice a year, preferably in the fall and spring. Apply a small amount of a high quality lubricant such as Mopar lock cylinder lubricant, P/N 4318084, directly into the lock cylinder. (Avoid excess lubricant.) Insert the key into the lock cylinder and rotate from the unlocked to the locked position — without adding more lubricant, repeat this procedure three or four times. Wipe all the lubricant off the key with a clean cloth to avoid subsequent soiling of clothing. If a lubricant is used that cannot be dispensed directly into the lock cylinder, apply a small amount of the lubricant to the lock cylinder key. Insert the key into the lock cylinder, then proceed as described above, in order to distribute the lubricant within the lock cylinder.

HEADLIGHTS

To assure correct adjustment of headlight aiming, it is recommended that the headlights be checked and, if necessary, realigned properly every six months.

Changes in front and rear suspension, such as front suspension height and/or deflection of rear springs due to heavy load, will change the headlight beam pattern and may cause unsafe night time driving conditions.

If a vehicle is to be loaded abnormally, such as for a vacation trip, or with a salesman's products, the headlight aiming should be checked and adjusted to serve the new conditions. Refer to Group 8L, "Exterior Lighting", for adjusting procedures.

SPEEDOMETER CABLE

Lubrication of speedometer cable is not required. For service of noisy or erratic operation of cable see "Electrical", Group 8E.

TOWING RECOMMENDATIONS

Recommended Towing Equipment

When towing a Chrysler Motors vehicle a SAE approved sling-type towing device (Fig. 1) may be used. A crossbeam and spacer blocks (Fig. 2) may be required for proper attachment. In most sling-type towing applications J-hooks are recommended for attaching the sling crossbar to the underside of the vehicle. When J-hooks cannot be used, T-hooks are required (Fig. 3). If T-hooks are being used, be sure the elongated hole in the chassis is reinforced and the T-hook shank is in line with the hole (Fig. 4).

Many of Chrysler Motor vehicles are equipped with air dams, spoilers, or ground effects skirting which

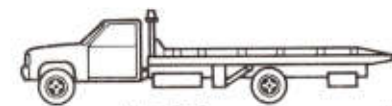
make sling-type towing impractical. In these cases the use of a wheel-lift or flat-bed towing device (Fig. 1) is recommended. When using a wheel-lift towing device, be sure the unlifted end has a minimum ground clearance of 5 inches; if not, use a towing dolly. If a flat-bed towing device is used, the approach ramp angle should not exceed 15 degrees.



SLING-TYPE



WHEEL LIFT



FLAT BED

RR00D29

Fig. 1—Recommended Towing Devices

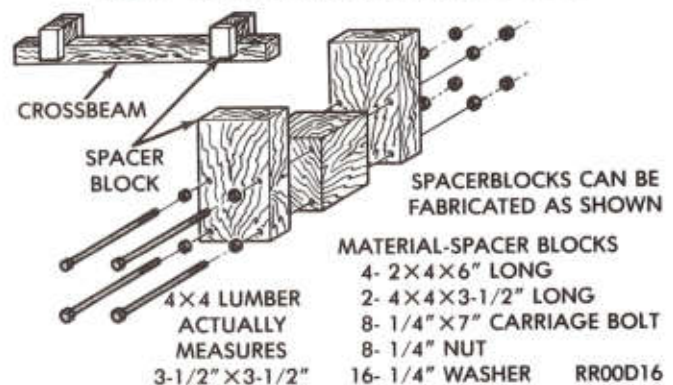
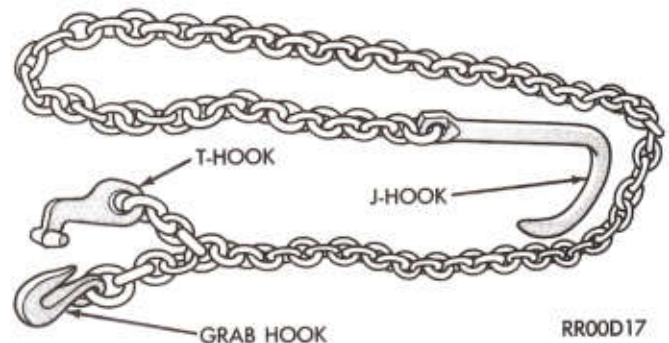


Fig. 2—Crossbeam and Spacer Block Construction



RR00D17

Fig. 3—Towing Chains and Hooks

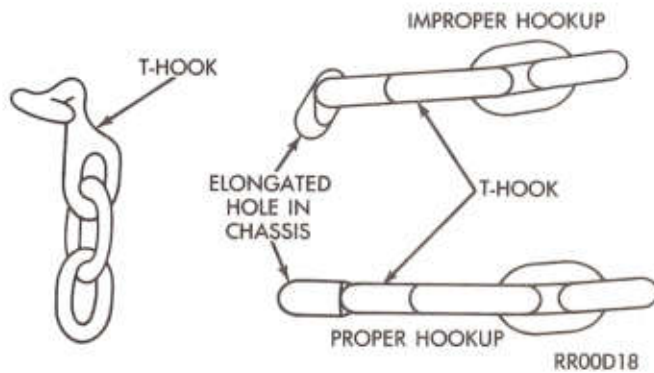


Fig. 4—T-Hook Usage

Lifting-Ground Clearance

Towed vehicle should be raised until lifted wheels are a minimum of 4 inches from the ground. Be sure there is adequate ground clearance at the opposite end of the vehicle, especially when towing over rough terrain or when crossing sharp rises such as curbs. If necessary, ground clearance can be increased by removing the wheels (secure brake drums when using rear pickup method) from the lifted end of the disabled vehicle and carrying the lifted end closer to the ground. An eight inch ground clearance must be maintained between brake drums or rotors and ground.

Rear Towing Pickup

2WD vehicles may be towed on the front wheels for extended distances at speed not to exceed 50 km/h (30 mph). It is recommended that the rear pickup method be used when possible.

4WD vehicles may be towed (transfer case in neutral) on the front wheels for distances not to exceed 25 km (15 miles). For extended distances, the front propeller shaft should be disconnected.

The steering wheel must be clamped in the straight-ahead position with a steering wheel clamping device designed for towing service use. **Do not use steering column lock to secure front wheel position for towing.**

Front Towing Pickup

Care must be taken when lifting the vehicle from the front so that the lower spoiler will not be damaged.

MANUAL TRANSMISSION vehicles may be towed on the rear wheels at speeds to 50 km/h (30 mph) for a distance of 25 km (15 miles), provided the transmission is in neutral and the driveline has not been damaged.

AUTOMATIC TRANSMISSION vehicles may be towed on the front wheels at speeds not to exceed 40 km/h (25 mph) for a distance not to exceed 25 km (15 miles). **CAUTION:** If these limits cannot be met, the front wheels must be placed on a tow dolly or the propeller shaft should be disconnected.

Front or Rear Pick-up Equipment

A towing sling (Holmes TS-100 Universal) or equivalent type and a G-209 1/2" Crosby-Laughlin shackle (clevis) or equivalent type attached to the grab hook end of each two chains is recommended. In addition, depending on vehicle, 4 x 4" lumber, spacing material may be required.

Towing When Keys Are Not Available

When vehicle is locked and keys are not available, place rear wheels on a dolly and lift and tow from front. As an alternative (providing the parking brake is released), all vehicles covered in this section may be towed with the rear drive shaft disconnected.

Safety Precautions

The following precautions should be taken when towing the vehicle.

(1) Remove exhaust tips and any other optional equipment except bumper guards, that interfere with the towing sling. Padding (heavy cloth or carpeting) should be placed between the tow sling and any painted surfaces.

(2) When placing the tow hooks on the rear axle, position hooks so as not to damage brake lines.

(3) **DO NOT ALLOW ANY OF THE TOWING EQUIPMENT TO BEAR ON THE FUEL TANK.**

(4) Vehicle is not to be towed by hooking on the front or rear shock absorbers or coil springs.

(5) **DO NOT LIFT OR TOW THE VEHICLE BY ATTACHING TO OR WRAPPING AROUND THE BUMPER.**

(6) A safety chain system completely independent of the primary lifting and towing attachment must be used.

(7) Any loose or protruding parts of damaged vehicle, such as hoods, doors, fenders, trim etc., should be secured prior to moving the vehicle.

(8) Operator should refrain from going under a vehicle while it is lifted by the towing equipment, unless the vehicle is adequately supported by safety stands.

(9) Never allow passengers to ride in a towed vehicle.

(10) State and local rules and regulations must be followed when towing a vehicle.

(11) All Models — front and rear.

The instructions apply to vehicles with standard equipment. Optional Campers, special bodies, front tire mounts, trailer hitches, etc., must be given due consideration.

(12) Light Truck Models Towed from the Rear:

CAUTION: Heavy loaded vehicles. Frame rails are designed to flex under heavy loading. If the vehicle is lifted and towed under this condition, the frame rail flex may be increased enough to allow box to cab contact and could cause damage to box and/or

cab. A towing dolly or flatbed carrier is desirable for "heavy loaded vehicles."

Rear Pickup Using Sling Device (front wheels on the ground)

CAUTION: Use J-hooks only. Rear T-hook receptacles are not designed for use with sling towing method (Fig. 4).

Pickup vehicle as shown in figures 5 or 6.

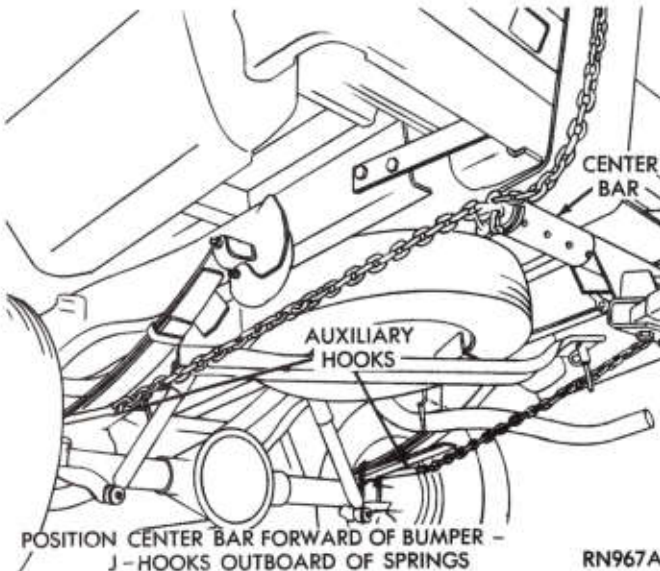


Fig. 5—Rear Pickup, D and W Models

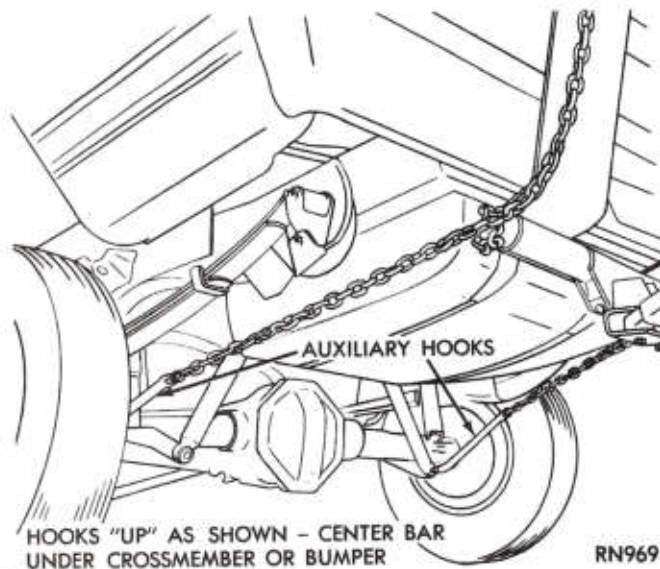


Fig. 6—Rear Towing Pickup, Sport Utility

Front Pickup Using Sling Device (rear wheels on the ground)

Pickup vehicle as shown in Figures 7 or 8.

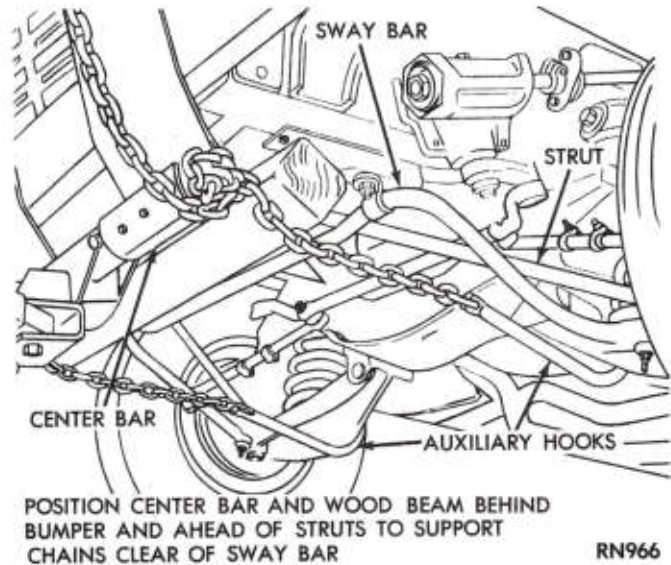


Fig. 7—Front Towing Pickup (2-Wheel Drive Models)

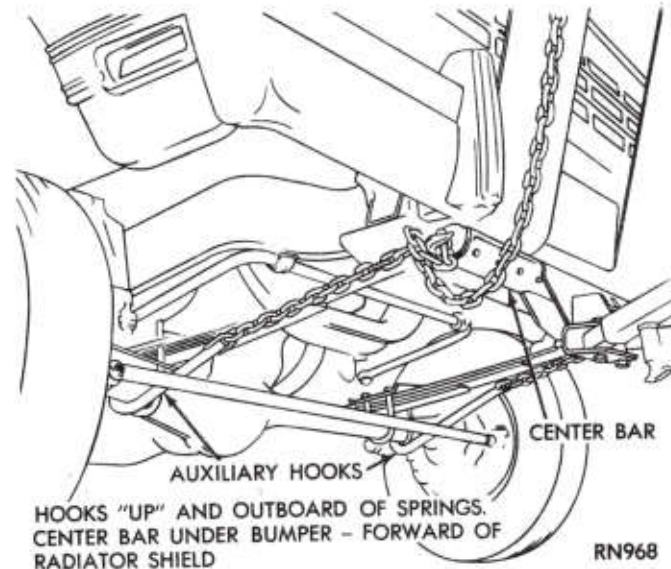


Fig. 8—Front Towing Pickup (4-Wheel Drive Models)

VEHICLE STORAGE

Vehicles that may be stored for varying intervals require protection against deterioration. Vehicles should be driven a minimum of 25 highway miles per month after the engine has reached normal operating temperature. This will prevent the accumulation of condensation and formation of rust on internal engine components such as cylinder bores.

Maintain the fuel level in the main tank between 3/4 full and full. This prevents the possibility of carburetor gum formation which will cause starting

problems and poor mileage.

Normal maintenance services should be carried out at the time or mileage intervals specified.

If the vehicle cannot be driven each month, prepare the vehicle according to the appropriate procedure to prevent damage to the engine and chassis.

Storage for 1 Month

Vehicles inoperative for one month require the following maintenance:

(1) Add one quart of special rust preventive oil, MOPAR Engine Oil Supplement, Part Number 438002 or equivalent, for each five gallons of gasoline in the fuel tank.

(2) Run the engine at the 1000 rpm for five minutes.

Storage for 1 to 3 Months

Vehicles inoperative for one to three months require the following maintenance in addition to those described above.

(1) Drain fuel tank and operate engine until carburetor runs dry.

(2) Remove spark plugs and pour 2 ounces of special rust preventive oil into each cylinder through the plug opening. Crank the engine. Replace plugs and tighten to 30 foot pounds.

(3) Remove valve covers and coat rocker arms, rocker arm shaft, valve springs, push rods and valve stems with special rust preventive oil.

(4) Check cooling system for leaks and proper antifreeze protection.

Storage for More Than 3 Months

Vehicles inoperative for more than 3 months require the following maintenance in addition to those described above.

(1) Place the vehicle on blocks or jackstands to remove weight from tires. Inflate tires to recommended pressure.

(2) Check the transmission, rear axle and steering system for proper lubricant level.

(3) Disconnect battery cables. Clean and coat cable terminals with grease. Remove battery and place on trickle charge.

ACCESSORIES

SNOW PLOW

CONTENTS

	Page		Page
DIAGNOSIS	7	POWER ANGLING CYLINDERS	13
GENERAL INFORMATION	1	SERVICE PROCEDURES	8
MECHANICAL	1	SNOW PLOW CONTROL WIRING	8
ELECTRO-HYDRAULIC UNIT	1	SNOW PLOW EXTERIOR LIGHTING	9
SYSTEM FUNCTION CHARTS	3	SPECIFICATIONS	14
VALVES	1	TIGHTENING REFERENCE	14

GENERAL INFORMATION

The Dodge Snow Plow attachment is available as extra equipment. The major mechanical parts are shown in Figure 1.

MECHANICAL

A brief description of these parts with numbers keyed to the figure as follows:

- (1) MOLDBOARD—High tensile steel, strong but lightweight.
- (2) TRIP SPRINGS—Allow moldboard to trip forward and ride over immovable obstructions without losing snow load—protects snow plow and truck.
- (3) SECTOR—High strength steel—has five positions for positioning straight or angling to right or left.
- (4) SECTOR SHEAR-PIN—Not used with power angling—Self-locking pin locks moldboard in a

straight or angled position. The Sector Shear-Pin shears under hard impact with obstructions to protect snow plow and truck.

(5) POWER ANGLING CYLINDERS—Enable the operator to position the Moldboard straight ahead or to right or left hydraulically while plowing.

(6) HINGE PINS—Allow plow to be attached or detached in minutes without tools.

(7) CUTTING EDGE—Replaceable steel grader blade provides extra long life.

(8) RUNNERS—Adjustable and replaceable runners hold Cutting Edge at proper height.

(9) SNO-FLO PAINT—Specifically developed high-visibility yellow paint provides fast, smooth snow-rolling action.

(10) HYDRAULIC CYLINDER & MOTOR (Electro-Touch™)—Raises and lowers snow plow hydraulically.

(11) A-FRAME

(12) LIFT ARM

ELECTRO HYDRAULIC UNIT

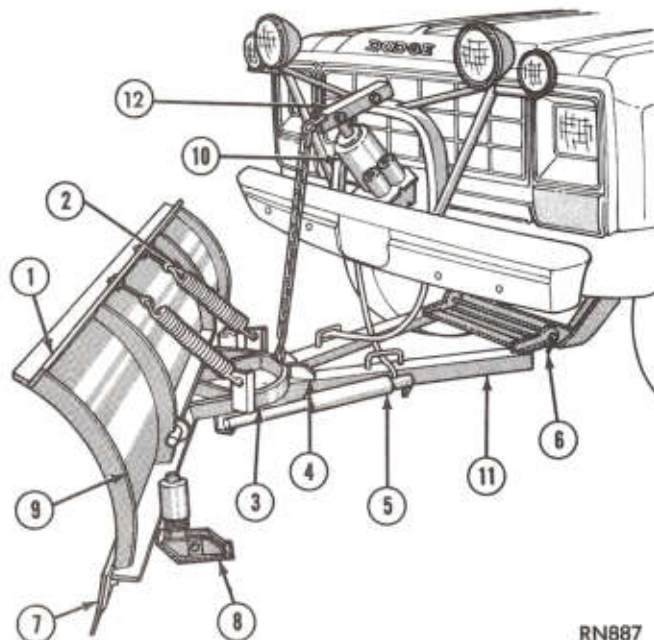
The power unit is an electrically powered and electrically controlled hydraulic mechanism specifically designed to raise, lower and angle the blade.

The unit consists of a high torque 12 volt motor which is directly coupled to a gear type hydraulic pump. A pilot-operated solenoid mounted under the hood supplies battery power to energize the motor. The pump obtains its supply of hydraulic fluid from an integral reservoir which totally surrounds the integral hydraulic cylinder that raises and lowers the blade.

The remote (dash mounted) toggle switches electrically operate the electro hydraulic units solenoid valves. The solenoid valves, designated, "A", "B", and "C", along with check valves, pilot and crossover relief valves control the pressurized hydraulic fluid for plow maneuvers.

VALVES

Hydraulic valves all have the same function: control the direction of oil flow.



RN887

Fig. 1—Snow Plow

Solenoid Valves

Three types are used. Each Solenoid Valve consists of two components: the Cartridge and Coil.

Cartridge: The cartridge consists of the hydraulic valve mechanism and an armature which enables the valve mechanism to be operated and controlled electrically. The cartridge screws in and out of the power unit much like the typical spark plug.

Coil: The coil is the electrical component which operates the cartridge valve mechanism. With power on the armature (connected to the valve mechanisms only moving part) pulls the spool or poppet valve into an alternate position.

When the current flow ceases a compressed coil spring pushes the armature (and valve mechanism) back to its original de-energized position.

"A" Solenoid Valve

The "A" cartridge contains a poppet valve whose static or de-energized position is open. In operation the valve retains hydraulic fluid in the lift cylinder. It is energized (opened) to allow the hydraulic fluid to flow from the lift cylinder back to the reservoir enabling the plow to lower by gravity.

This valve is designed to remain energized (open) during plow operation to provide the "float" position to ensure that the plow maintains contact with the ground contour.

"B" Solenoid Valve

The "B" cartridge contains a spool valve whose static (de-energized) position allows the pressurized hydraulic fluid to flow to the "C" Solenoid Valve. In the energized position, the pressurized hydraulic fluid is diverted to the lift cylinder, raising the plow.

"C" Solenoid

The "C" cartridge contains a spool valve whose static (de-energized) position allows the pressurized hydraulic fluid to flow to the right power angling cylinder which angles the plow to the left. At the same time, it allows the hydraulic fluid being forced from the retracting left angling cylinder to flow through the "C" cartridge back to the reservoir.

Energizing the valve diverts pressurized fluid to the left angling cylinder, angling the plow to the right. Also the hydraulic fluid being forced from the retracting right angling cylinder flows through the "C" cartridge back to the reservoir.

Check Valves

Check valves allow fluid to pass freely in one

direction while preventing fluid from passing in the opposite direction.

In all models a Pump Check Valve is used to prevent fluid from leaking back through the pump to the reservoir.

Two additional check valves are necessary because "B" and "C" Solenoid Valves, being spool valves, have some leakage.

One check valve is located between the "B" solenoid valve and the lift cylinder. It prevents fluid in the lift cylinder from leaking back through the "B" solenoid valve which could cause the weight of the plow to angle the plow to the left by forcing fluid through the "C" solenoid valve into the right power angling cylinder.

The other check valve is located between "B" and "C" solenoid valves. It prevents the hydraulic fluid in either power angling cylinder from being forced through the "B" solenoid valve to the left cylinder.

Pilot Check Valve

The pilot check valve is more sophisticated in that it incorporates a piston in addition to the ball seat and spring. It is located between the "C" solenoid valve and reservoir. It has two functions: The first to prevent the hydraulic fluid in either angling cylinder from leaking back to the reservoir. The second is to allow the hydraulic fluid from the retracting angling cylinder (during the angling cycle) to return to the reservoir. This is accomplished by the pressurized hydraulic fluid moving the piston which forces the check ball off its seat.

Crossover Relief Valves

The crossover relief valve has the function of protecting against damaging forces of abnormally high loads applied against the end of the blade (blade end hitting curb or obstacle) causing very high hydraulic pressure to build up in one angling cylinder.

When the produced pressure is high enough it opens the crossover relief valve, allowing the highly pressurized hydraulic fluid to flow directly to the opposite power angling cylinder. This function helps absorb the impact with only a change in angled position of the plow.

SYSTEM FUNCTION

Refer to Figures 2 through 5 for electrical and hydraulic flow for each function. Each figure explains which component is actuated and related in each function.

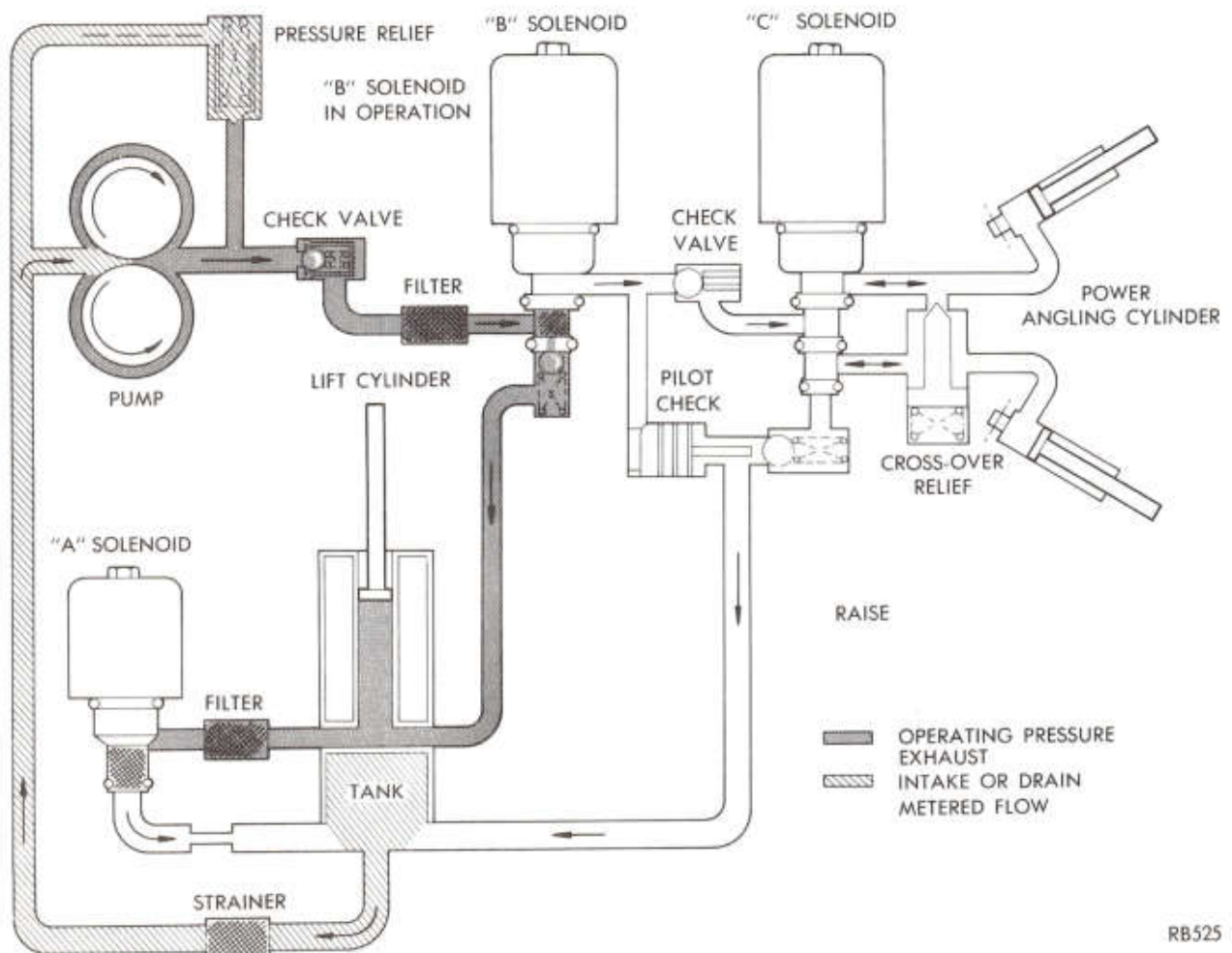
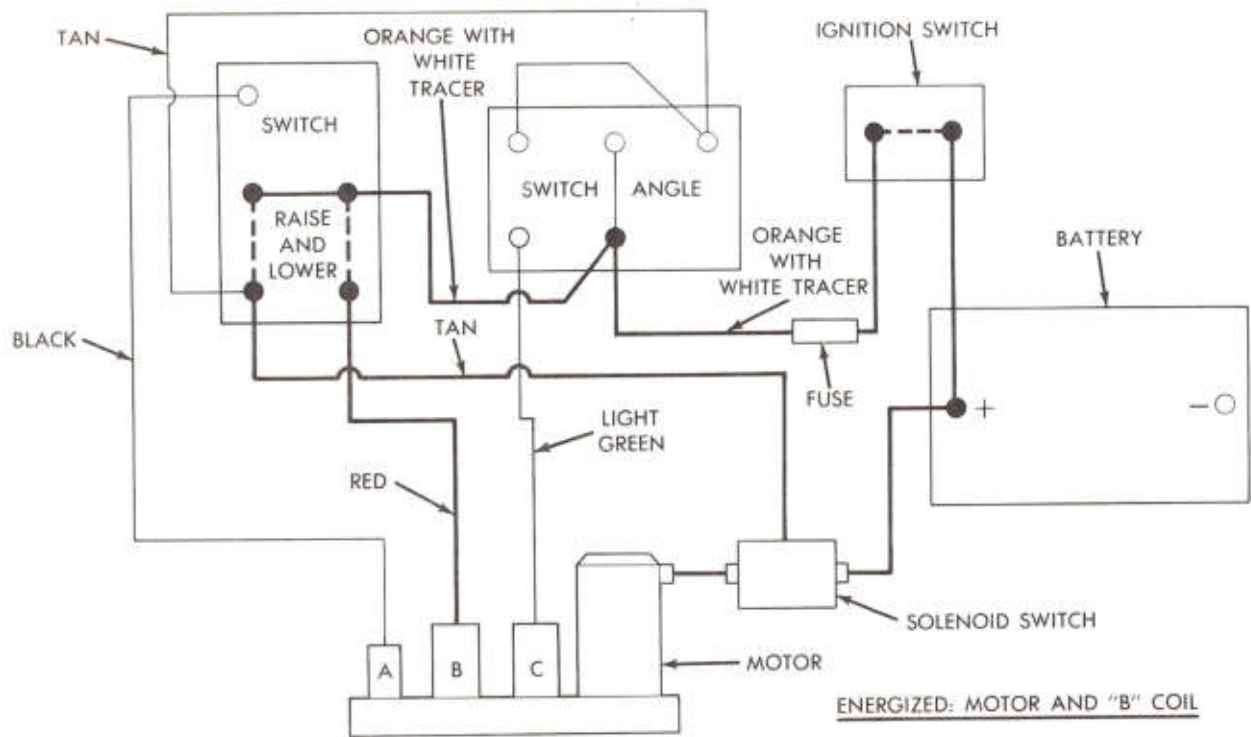


Fig. 2—Raise, Hydraulic and Electrical Flow Chart

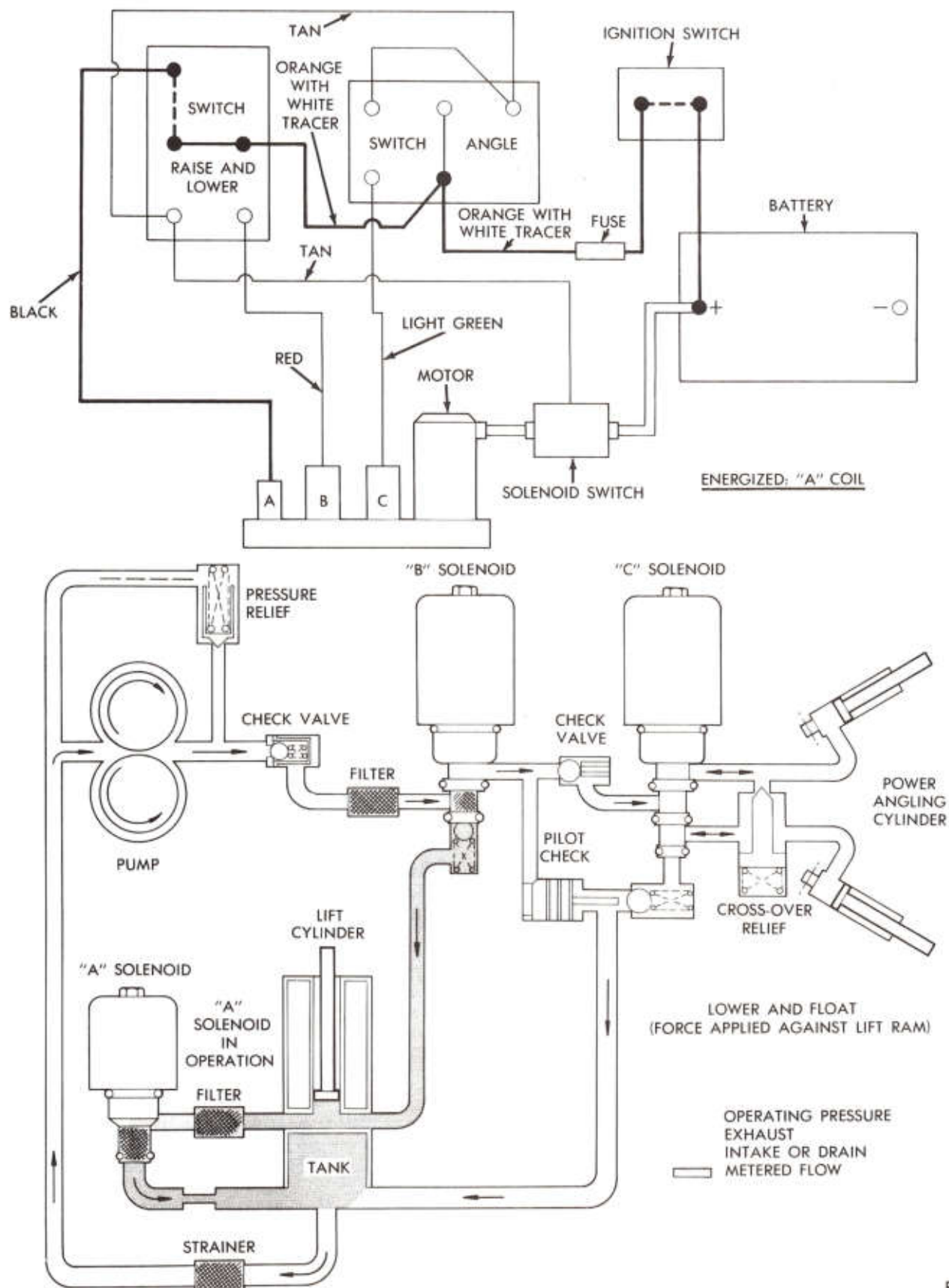


Fig. 3—Lower and Float, Hydraulic and Electrical Flow Chart

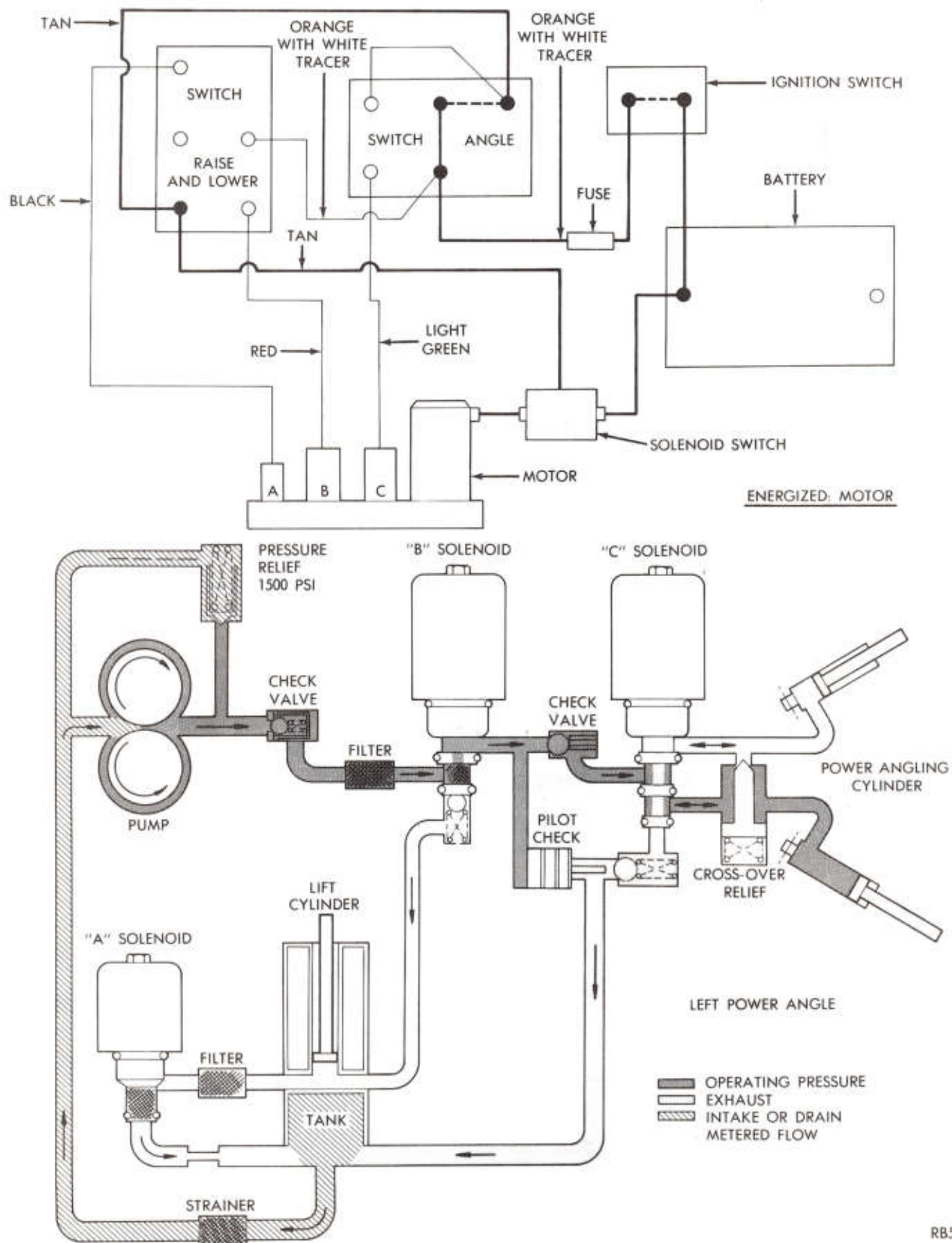


Fig. 5—Angle Left, Hydraulic and Electrical Flow Chart

SNOW PLOW DIAGNOSIS

Condition	Possible Cause	Correction
PLOW DOES NOT LIFT OR LIFTS SLOWLY—MOTOR OPERATES	(a) Low hydraulic fluid level. (b) Discharged battery. (c) Leaking or open "A" cartridge. (d) No current to "B" coil. (e) Inoperative "B" coil. (f) Malfunctioning motor. (g) Malfunctioning pump.	(a) Add fluid to proper level. (b) Recharge battery. (c) Clean or replace "A" cartridge. (d) Locate malfunction and repair. (e) Replace "B" coil. (f) Repair or replace motor. (g) Replace pump.
PLOW DOES NOT ANGLE RIGHT—MOTOR OPERATES	(a) Improper coupler engagement. (b) Mechanical bind or interference. (c) Malfunctioning coupler. (d) No current to "C" coil. (e) Inoperative "C" coil. (f) Inoperative "C" cartridge. (g) Leaking or open crossover relief valve.	(a) Engage coupler properly. (b) Eliminate mechanical bind or interference. (c) Repair or replace coupler. (d) Locate malfunction and repair. (e) Replace "C" coil. (f) Clean or replace "C" cartridge. (g) Clean or replace crossover relief valve.
PLOW DOES NOT ANGLE LEFT—MOTOR OPERATES	(a) Improper coupler engagement. (b) Mechanical bind or interference. (c) Malfunctioning coupler. (d) Leaking or open crossover relief valve.	(a) Engage coupler properly. (b) Eliminate mechanical bind or interference. (c) Repair or replace coupler. (d) Clean or replace crossover relief valve.
PLOW WILL NOT ANGLE—MOTOR OPERATES	(a) Improper coupler engagement. (b) Mechanical bind or interference.	(a) Engage coupler properly. (b) Eliminate mechanical bind or interference.
PLOW WILL NOT HOLD IN ANGLED POSITION	(a) Air in cylinders and hoses. (b) Leaking "C" cartridge O-rings. (c) Leaking or open pilot check valve. (d) Leaking crossover relief valve. (e) Crossover relief valve opening at too low a pressure.	(a) Bleed cylinders and hoses. (b) Replace O-rings. (c) Clean or replace pilot check valve. (d) Clean or replace crossover relief valve. (e) Replace crossover relief valve.
MOTOR DOES NOT OPERATE	(a) Discharged or defective battery. (b) Loose or corroded electrical connections. (c) Inoperative solenoid switch. (d) Malfunctioning control switch. (e) Malfunctioning motor.	(a) Recharge or replace battery. (b) Clean and tighten electrical connections. (c) Replace solenoid switch. (d) Replace control switch. (e) Repair or replace motor.
PLOW DOES NOT LOWER	(a) No current to "A" coil. (b) "A" cartridge jammed in closed position. (c) Inoperative "A" coil.	(a) Locate malfunction and repair. (b) Clean or replace "A" cartridge. (c) Replace "A" coil.
PLOW CREEPS DOWN	(a) Leaking "A" cartridge. (b) Leaking "A" cartridge O-ring. (c) Leaking Pump Check Valve. (d) Leaking Ram Packing Cup. (e) Leaking O-ring at bottom of lift cylinder.	(a) Clean or replace "A" cartridge. (b) Replace O-ring. (c) Clean or replace Pump Check Valve. (d) Replace Ram Packing Cup. (e) Replace O-ring.
PLOW DOES NOT LIFT OR LIFTS SLOWLY—MOTOR OPERATES	(a) Low hydraulic fluid level. (b) Discharged battery. (c) Loose or corroded electrical connections. (d) Leaking or open "A" cartridge. (e) Malfunctioning motor. (f) Malfunctioning pump.	(a) Add fluid to proper level. (b) Recharge battery. (c) Clean and tighten electrical connections. (d) Clean or replace "A" cartridge. (e) Repair or replace motor. (f) Replace pump.
PLOW CREEPS DOWN	(a) Leaking "A" cartridge. (b) Leaking "A" cartridge O-ring. (c) Leaking "B" check valve.	(a) Clean or replace "A" cartridge. (b) Replace O-ring. (c) Clean or replace "B" check valve.

Condition	Possible Cause	Correction
	(d) Leaking ram packing cup. (e) Leaking O-ring at bottom of lift cylinder.	(d) Replace ram packing cup. (e) Replace O-ring.
SNOW PLOW FAILS TO CLEAN SURFACE	(a) Runner height incorrect. (b) Cutting edge unevenly worn.	(a) Adjust runners. (b) Replace.
MOLDBOARD FAILS TO FOLLOW GROUND CONTOUR	(a) Not in "Lower Float Position". (b) Insufficient slack in lift chain.	(a) Position to "Lower Float". (b) Adjust lift chain.
SNOW STICKS TO FACE OF MOLDBOARD	(a) Sno-Flo paint worn off.	(a) Refinish.

SNOW PLOW WIRING

See Figures 6 and 7 for auxiliary wiring diagram for snow plow power unit, controls and special headlamps and turn signal lights.

For electric motor and solenoid specifications, see Electrical Specifications at rear of this group.

SERVICE PROCEDURES

Diagnosis

When malfunctions are encountered, refer to Diagnosis Charts and Hydraulic Flow Charts before disassembling.

Disassembly and Inspection

- (1) Remove drain plug (Fig. 8). Drain unit.
- (2) Extend ram and piston rod assembly fully to drain remaining oil in cylinder.
- (3) Remove cover locknuts (Fig. 8) and remove.
- (4) Inspect casting for damage or cracks and seal for cuts (Fig. 9).
- (5) Remove ram and piston. Check nylon sleeve, piston, and piston follower for excessive wear.
- (6) Inspect cylinder for pitting and scoring in bore.
- (7) Inspect ram for nicks, scratches, rust, and corrosion.
- (8) Inspect piston packing cup for wear or cut sealing lip.
- (9) Clean and inspect base strainer.
- (10) Replace all O-rings at assembly.
- (11) Loosen motor attaching bolts. Do not remove bolts from motor. **Hold or secure motor endplate in place during removal, then, temporarily install two 1/4-20 nuts on motor attaching bolts to keep motor intact.**

Motors: Both Prestolite and American Bosch motors are used. Prestolite can be identified by a domed top cover and the name stamped on the body. American Bosch motors have a flat top cover and no identifying marks.

- (12) Remove pump drive shaft seal (if damaged) with pointed tool.

Verify correct seal kit replacement components.

- (13) Dip new seal in oil and install over pump shaft with seal lip down.
- (14) Position seal into pump housing and position

slightly below face of boss.

- (15) Remove "A" solenoid coil from base and test for electrical continuity. Normal coil resistance is 7.6 ohms.

- (16) Remove "A" solenoid cartridge (two way valve) with 1-1/8" deepwell socket and inspect for external damage.

- (17) Remove filter assemblies and clean screens with solvent and compressed air. Discard O-rings and nylon retaining rings.

- (18) Remove pump housing and remove insert valve, ball spring, and retainer from base (Fig. 10.). Inspect for damage or contamination. Discard O-rings.

- (19) Remove socket-head screws and remove valve block from base. Discard O-rings.

- (20) Remove "B" solenoid (3-way valve) with special tool J-25399. Remove ball and spring from valve block. Clean solenoid and inspect for external damage.

- (21) Disassemble 3-way valve. Discard O-ring.

- (22) Remove and clean "C" solenoid (4-way valve) with special tool J-25399. Inspect solenoid for external damage.

- (23) Disassemble 4-way valve. Discard O-rings. (Fig. 11).

- (24) Test coils and 4-way for electrical continuity. Normal coil resistance is 3.5 ohms.

- (25) Remove pilot check valve plug, spring and ball from bottom of valve block.

- (26) Inspect spring for damage and ball seat for nicks.

- (27) Remove acorn nut to gain access to crossover valve components.

- (28) Remove crossover valve components (Fig. 12). Inspect for external damage. Discard O-rings.

- (29) Seat poppets if necessary after block is cleaned.

- (30) With all parts removed from block, clean block with compressed air to remove foreign material.

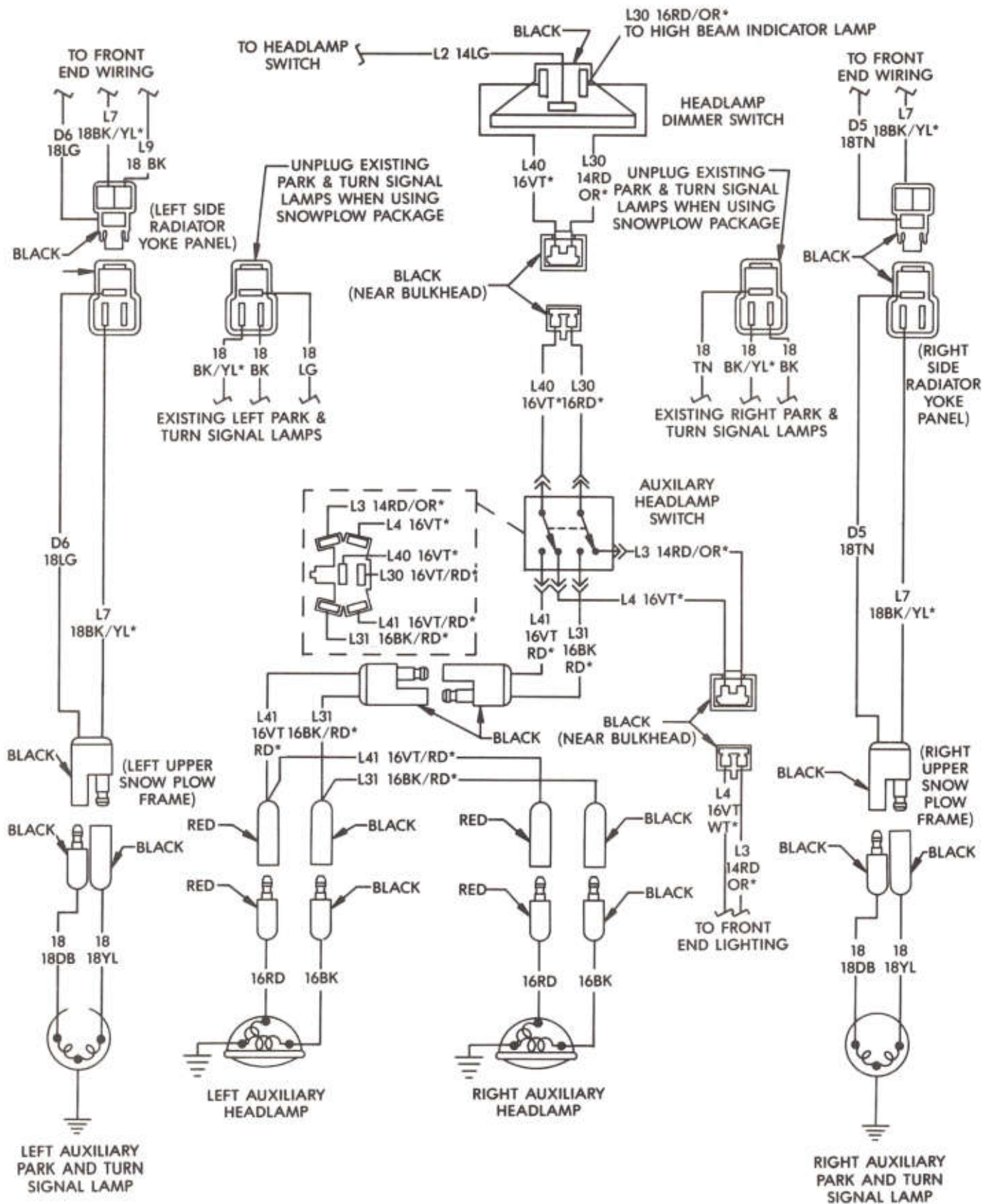


Fig. 6—Snow Plow Exterior Lighting

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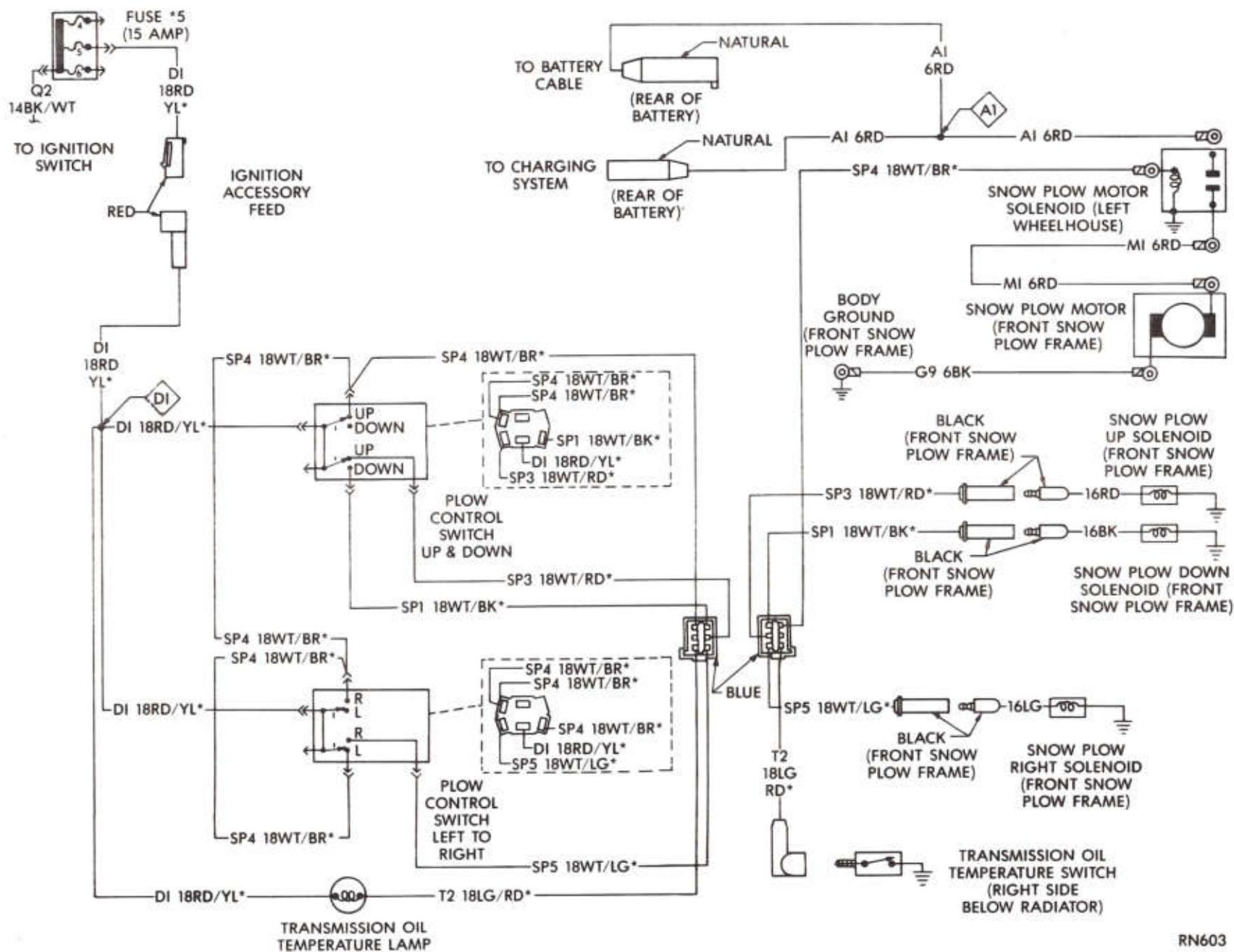
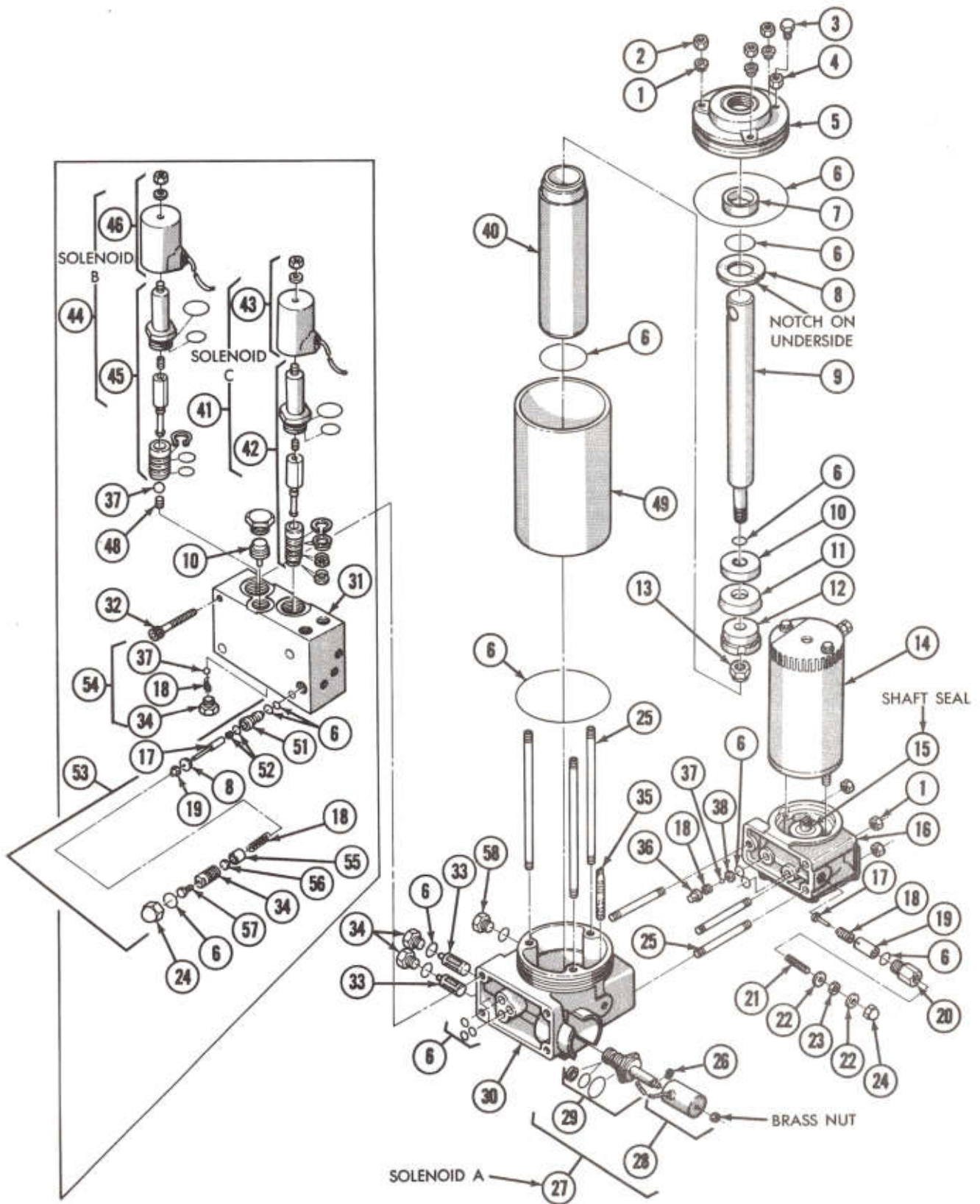


Fig. 7—Snow Plow Control

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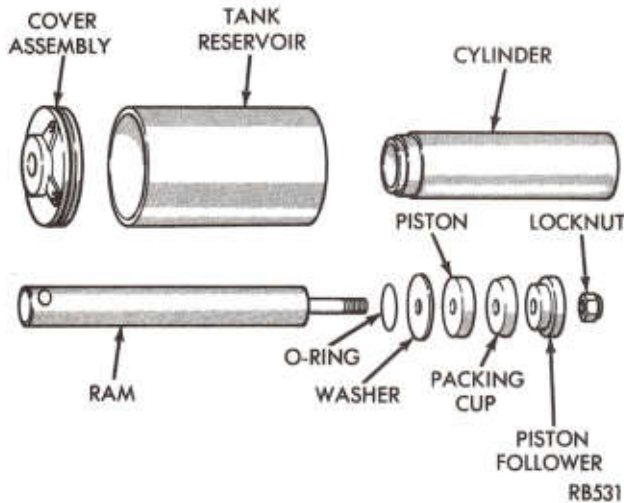


Fig. 9—Lift Cylinder Components

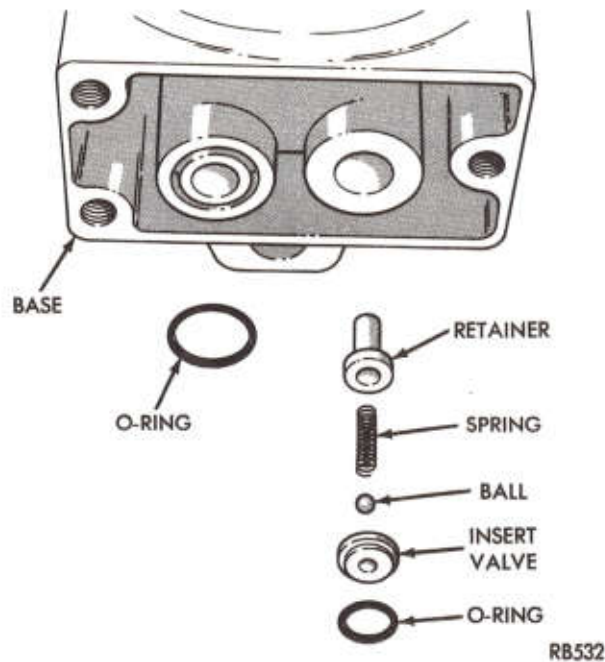


Fig. 10—Insert Valve (Exploded View)

A, B, and C SOLENOID VALVES

Check solenoid valve coils to determine if they are receiving current and functioning properly, as follows:

(1) Hold a steel screwdriver blade approximately 1/8 inch above the retaining nut on the coil being checked.

(2) Have assistant position the control switch which energizes the coil (Example: place the Raise and Lower Switch in Lower and Float positions to energize the A coil).

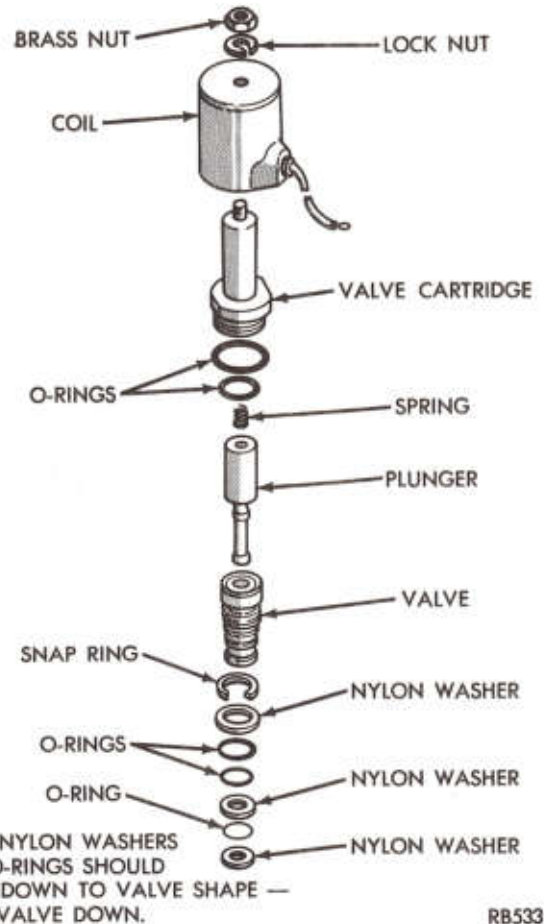
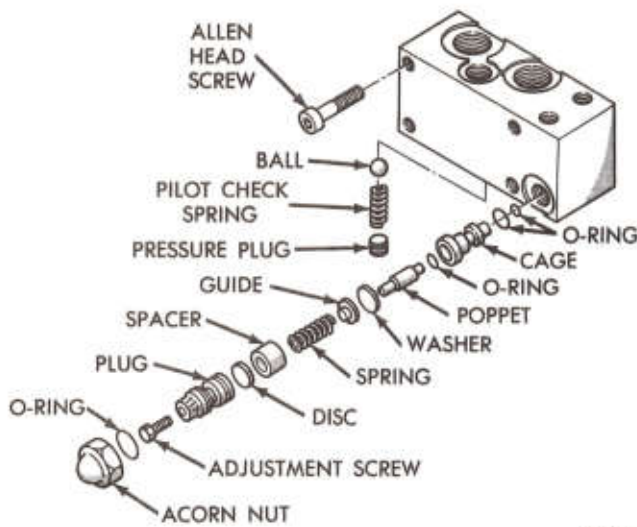


Fig. 11—Four-Way Valve ("C" Solenoid) (Exploded View)

LEGEND FIG. 8

- | | | | |
|----------------------------|--------------------------------|---------------------------|-----------------------|
| 1. Plastic Washer | 16. Pump Assembly | 31. Valve Block | 45. 3-Way Valve |
| 2. Locknut | 17. Poppet | 32. Socket Head Cap Screw | 46. 3-Way Coil |
| 3. Pressure Relief Valve | 18. Spring | 33. Filter | 47. Cap Plug |
| 4. Filler Plug | 19. Guide | 34. Plug | 48. Check Spring |
| 5. Cover and Seal Assembly | 20. Retainer | 35. Strainer | 49. Cylinder Tank |
| 6. O-Ring | 21. Setscrew | 36. Check Valve Retainer | 50. Valve Block |
| 7. Sleeve | 22. Aluminum Washer | 37. Ball | 51. Cage |
| 8. Washer | 23. Jamnut | 38. Insert Valve | 52. O-Ring/Glide Ring |
| 9. Ram Assembly | 24. Acorn Nut | 39. Cylinder Tank | 53. Crossover Valve |
| 10. Piston | 25. Stud | 40. Cylinder | 54. Pilot Check Valve |
| 11. Packing Cup | 26. Brass Washer | 41. 4-Way Solenoid | 55. Spacer |
| 12. Piston Follower | 27. 2-Way Solenoid | 42. 4-Way Valve | 56. Disc |
| 13. Locknut | 28. 2-Way Coil | 43. 4-Way Coil | 57. Adjusting Screw |
| 14. Motor | 29. 2-Way Valve | 44. 3-Way Solenoid | 58. Drain Plug |
| 15. Shaft Seal | 30. Base and Strainer Assembly | | |



RB534

Fig. 12—Crossover Relief Valve

(3) When the coil is receiving current and is functioning properly, the magnetism produced will pull the screwdriver down to the retaining nut.

Absence of magnetic attraction only focuses in on the problem area. An ohmmeter or continuity tester should then be used to determine whether current is reaching the coil.

Assembly

Before assembly, be sure all components are thoroughly clean and free of all foreign matter. Use new replacement gaskets and seals during assembly. Petroleum jelly or equivalent may be used as an aid in location and installation of rubber O-rings.

(1) Install crossover valve components in valve block using new O-rings.

(2) Install ball, spring and pressure plug using new O-ring in bottom of valve block.

(3) Assemble 4-way valve with new O-rings and nylon retainer rings.

(4) Install 4-way solenoid C valve with Tool J-25399.

(5) Assemble 3-way valve using new O-ring.

(6) Install ball, spring and 3-way solenoid B valve with Tool J-25399.

(7) Install valve block and new O-rings to base.

(8) Install pump housing and retainer, spring ball and insert valve using new O-rings. Tighten pump attaching nuts to 100 to 125 inch-pounds (11 to 14 N·m) torque.

(9) Install filter screws.

(10) Install 2-way solenoid to base.

(11) Install "A" coil.

(12) Install motor to pump engaging gear shaft tang with notch in motor output shaft. Tighten motor attaching bolts to 45 to 55 inch-pounds (5 to 6 N·m) torque.

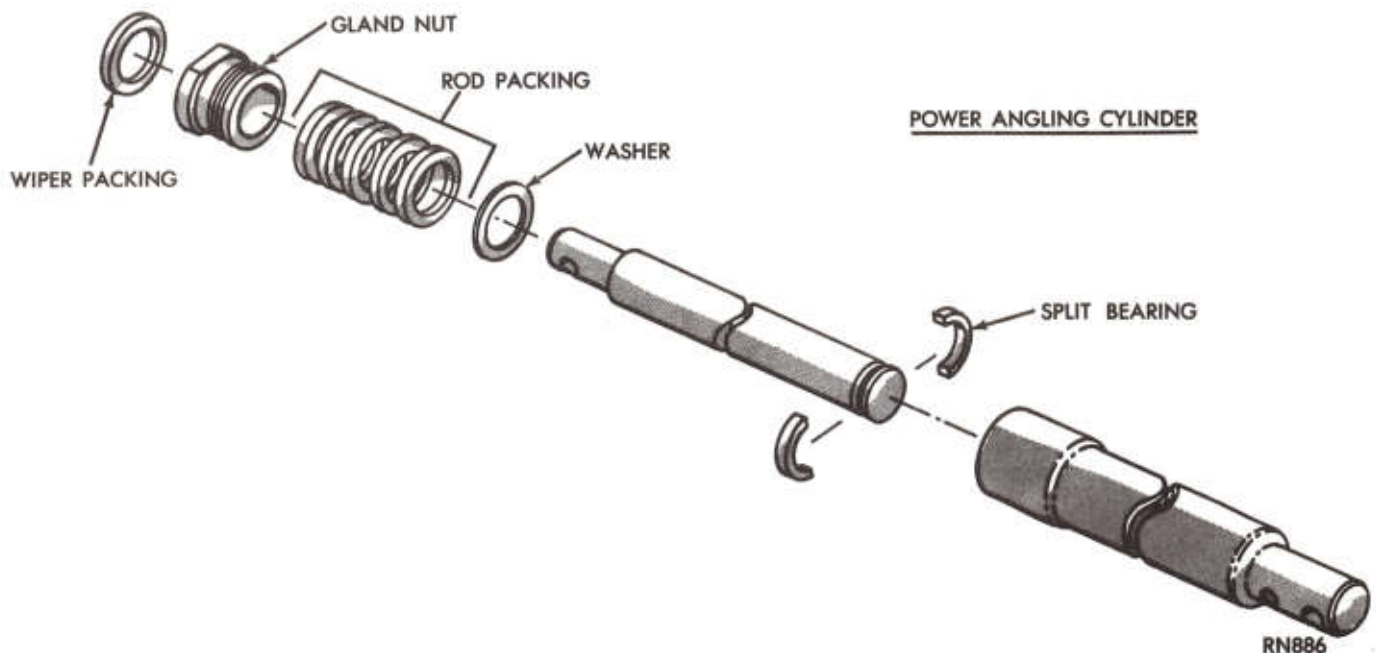
(13) Install ram and piston using new O-rings.

(14) Position cover assembly on reservoir and secure with locknuts.

POWER ANGLING CYLINDERS

If cylinder leakage occurs (wetting is normal) the gland nut may be loose. Tighten gland nut.

CAUTION: Over tightening gland nut can lock cylinder. Leakage may not cease immediately since oil has accumulated between packing and gland nut. If leakage persists after continued usage, replace rod packing (Fig.13).



RN886

Fig. 13—Angling Cylinders

SPECIFICATIONS

ELECTRICAL

MOTOR

American Bosch M0551046A

No load (motor not attached to pump)

NOTE: Do not operate motor continuously for more than 30 seconds.

Applied Voltage	12 Volts DC
Max. Current Draw	24 Amperes
Speed (Min.)	5900 rpm

Under load (pump operating in relief)

NOTE: Do not operate motor continuously for more than 5 seconds.

Applied Voltage	12 Volts DC
Max. Current Draw	230 Amperes

Prestolite MGL4105

No load (motor not attached to pump)

NOTE: Do not operate motor continuously for more than 30 seconds.

Applied Voltage	10 Volts DC
Max. Current Draw	45 Amperes
Speed (Min.)	10,000 rpm

Under Load (pump operating in relief)

NOTE: Do not operate motor continuously for more than 5 seconds.

Applied Voltage	12 Volts DC
Max. Current Draw	230 Amperes

SOLENOID VALVES A, B, AND C

A Coil

Applied Voltage	12 Volts DC
Current Draw	0.83 Amperes

Nominal resistance (ohmmeter lead connected to coil lead, other meter lead connected to metal coil cover)—7.6 ohms.

B and C Coils

Applied Voltage	12 Volts DC
Current Draw	1.24 Amperes

Nominal resistance (ohmmeter lead connected to coil lead, other meter lead connected to metal coil cover)—3.5 ohms.

SOLENOID SWITCH

Applied Voltage	12 Volts DC
Max. Current Draw	5 Amperes

Nominal resistance (ohmmeter lead connected to coil lead, other meter lead connected to metal foot)—2.65 - 4.5 ohms.

HYDRAULIC

PUMP

Pressure Output (pump relief valve setting)
1650 $\pm$ 50 psi

CROSSOVER RELIEF VALVE

Opening Pressure 3000 $\pm$ 100 psi

HYDRAULIC FLUID CAPACITY

1 Quart = 32 Fluid Ounces

Unit	28 oz.
Hoses & 1-1/2 x 10 Cylinders	16 oz.
Total	1 qt., 12 oz. (44 oz.)

Unit	28 oz.
Hoses & 1-1/2 x 12 Cylinders	19 oz.
Total	1 qt., 15 oz. (47 oz.)

Unit	1 qt., 4.5 oz. (36.5 oz.)
Hoses & 2 x 12 Cylinders	28 oz.
Total	2 qt., 5 oz. (64.5 oz.)

TIGHTENING REFERENCE

SNOW PLOW

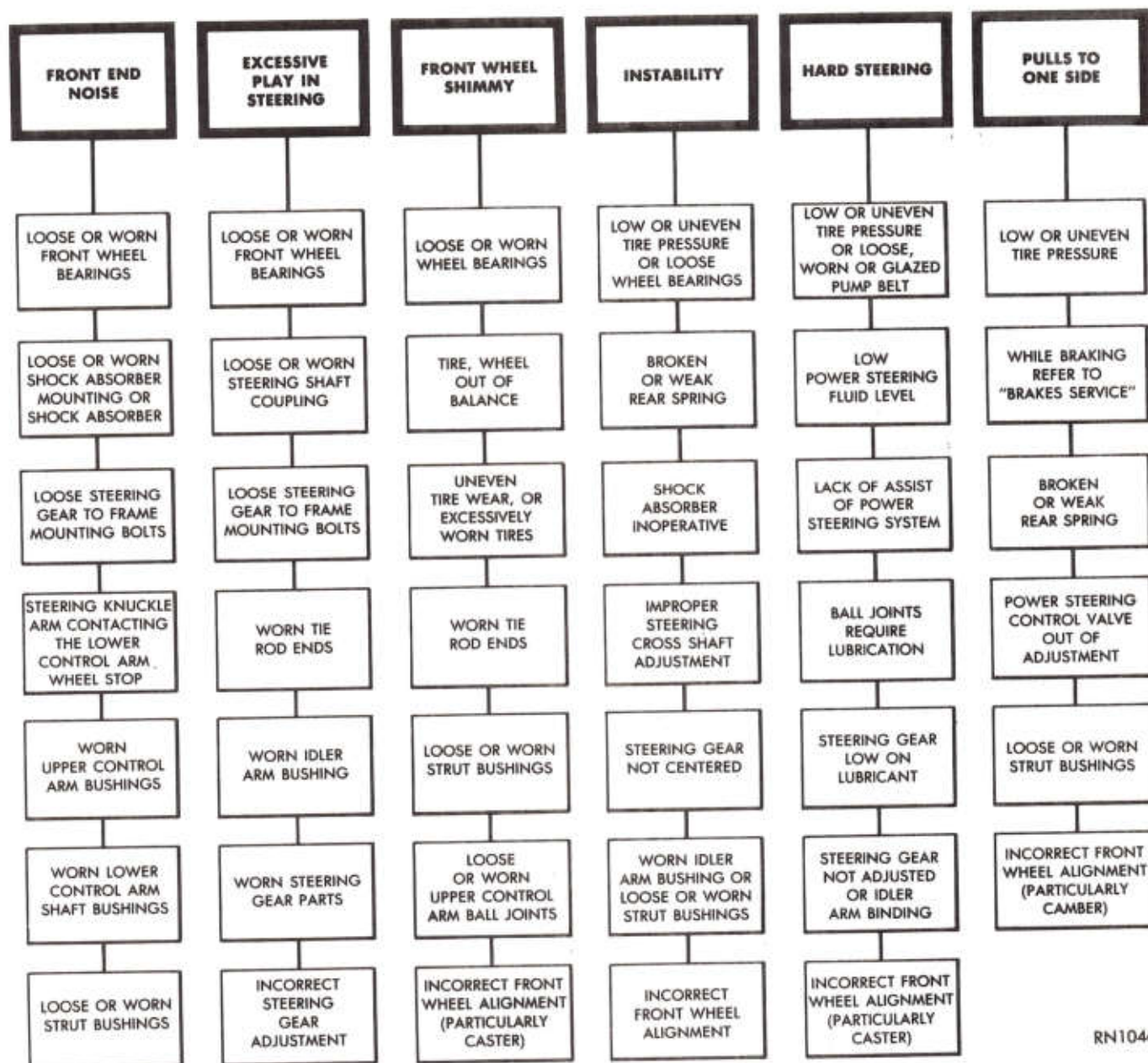
ELECTRO HYDRAULIC UNIT	Thread Size	U.S.A. Torque (In. Lbs.)	Metric Torque (N-m)
Reservoir Cover Retaining Nuts	5/16-24	100-125	11-14
Pump Assembly Retaining Nuts	5/16-24	100-125	11-14
Endplate or Valve Block Retaining Capscrews	5/16-18	100 $\pm$ 5	11 $\pm$ 1
Motor to Pump Retaining Capscrews	1/4-20	45-55	5-6

FRONT SUSPENSION

CONTENTS

	Page		Page
FRONT DRIVING AXLE (44-8FD)	10	DIAGNOSIS	1
FRONT DRIVING AXLE (60)	34	SPECIFICATIONS	55
INDEPENDENT FRONT SUSPENSION	2	TIGHTENING REFERENCE	56

FRONT SUSPENSION AND STEERING LINKAGE DIAGNOSIS



INDEPENDENT FRONT SUSPENSION

INDEX

	Page		Page
General Information	2	Steering Linkage	8
Front Coil Springs	4	Sway Bar (If So Equipped)	9
Lower Ball Joint	5	Tie Rod Ends	8
Lower Control Arm	5	Upper Ball Joint	6
Lower Control Arm Bushing	6	Upper Control Arm	6
Lower Control Arm Strut	4	Upper Control Arm Bushing	7
Pre-Alignment Inspection	3	Wheel Alignment	2
Shock Absorber	4	Specifications	55
Steering Knuckle	8	Tightening Reference	56

GENERAL INFORMATION

These vehicles are equipped with a coil spring front suspension system. The upper control arms are mounted on longitudinal rails and the lower control arms are mounted on a stationary crossmember. Both control arms have replaceable bushings on the inboard ends and replaceable ball joints on the outboard ends. The upper control arms also control the caster and camber adjustments through eccentric pivot bolts at the inboard ends.

Tension type lower ball joints are used on all models. The ball joints and tie rod ends are of the semi permanent lubricated type.

Lower ball joints should be replaced if more than .020 inch end play is found.

The tie rod end seals are serviced separately and should be inspected for damage at all oil change periods.

All front suspension points that contain rubber should be tightened while the suspension is at the specified height (see specifications), with full weight of vehicle on its wheels.

Rubber bushings should not be lubricated at any time.

SERVICE PROCEDURES

WHEEL ALIGNMENT

Front wheel alignment is the proper adjustment of all the interrelated suspension angles affecting the running and steering of the front wheels of the vehicle. The importance of wheel alignment and wheel balancing is considered essential in order to maintain ease of steering, good directional stability and to prevent abnormal tire wear.

Under every day driving conditions the front wheel alignment angles change and therefore it becomes necessary that every vehicle should have an alignment check at least once a year. Such an inspection of the front suspension and steering components is a preventative maintenance service and also has a definite bearing on the safe operation of the vehicle.

The method of checking front wheel alignment will vary depending on the type of equipment being used. The instructions furnished by the manufacturer of the equipment should always be followed, with the exception that the specifications as recommended by the Chrysler Corporation should always be used.

There are five basic factors which are the foundation to front wheel alignment; caster, camber, toe-in, steering axis inclination and toe-out on turns (Fig. 1).

All are mechanically adjustable except steering axis inclination and toe-out on turns. These two are valuable in determining if the parts are bent or damaged particularly when the camber and caster adjustments cannot be brought within the recommended specifications.

Do not attempt to modify any suspension or steering components by heating or bending.

All adjustments should be made in the following sequence:

- Caster and Camber.
- Toe-in.
- Steering Axis Inclination. (Not Adjustable)
- Toe-out on Turns.

Caster is the number of degrees of forward or backward tilt of the spindle support arm at the top. Forward tilt of the spindle support arm at the top is negative caster. Backward tilt of the spindle support arm at the top from true vertical is positive caster (Fig. 2).

Camber is the number of degrees the top of the wheel is tilted inward or outward from a true vertical. Inward tilt of the top of the wheel from true vertical is negative camber. Outward tilt of the wheel at the top is positive camber. Excessive camber is a tire wear

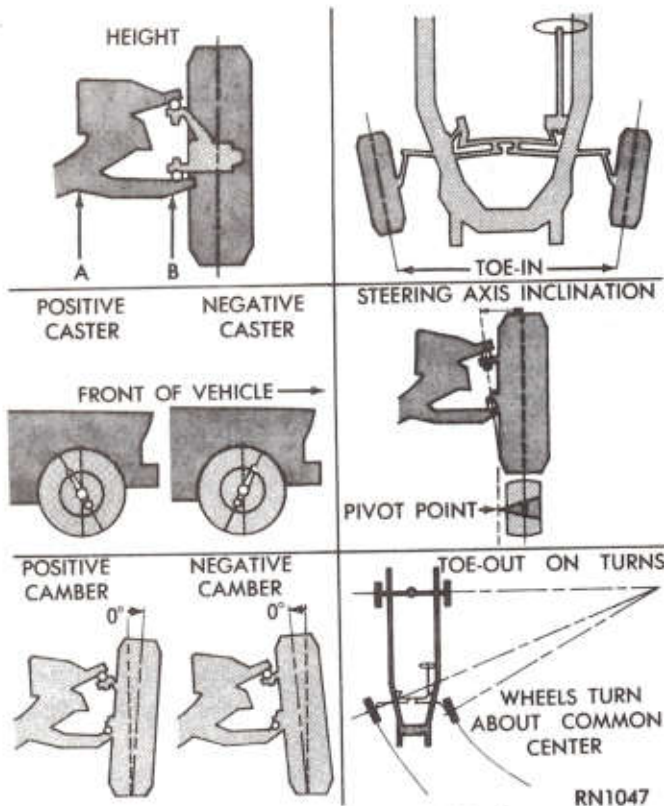


Fig. 1—Wheel Alignment Factors

factor; negative camber causes wear on the inside of the tire, while positive camber causes wear to the outside (Fig. 2).

Toe-in is measured in inches and is the distance the leading edges of the tires are closer than the trailing edges. Toe-in is considered the most serious cause for excessive tire wear. Toe-in is the last of the alignment angles to be set in the front wheel alignment operation.

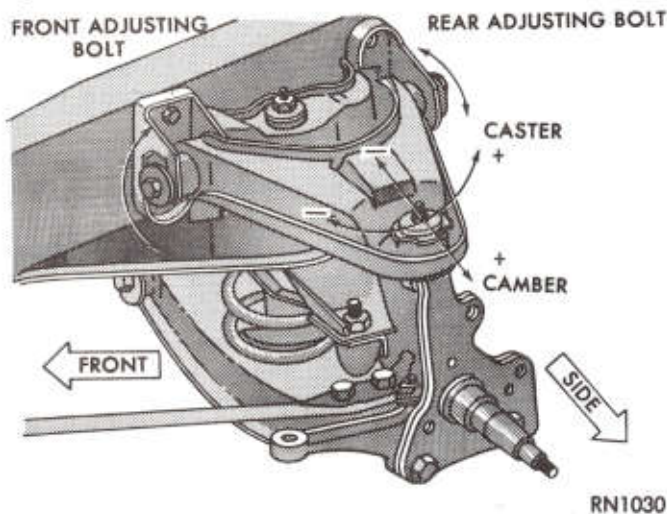


Fig. 2—Alignment Adjustment Locations and Directions

Steering Axis Inclination is measured in degrees and is the amount the spindle support center line is tilted from true vertical. It has a fixed relationship with camber settings and does not change except when a spindle or ball joint is damaged or bent. This angle is not adjustable and damaged parts must be replaced.

Toe-Out on Turns (Turning Radius) is measured in degrees and is the amount one front wheel turns sharper than the other on a turn. This angle is designed into the steering arm in relationship to the wheelbase of the vehicle and is not adjustable. When checking the turning radius and it is found not to be within the recommended specifications, look for possible bent or damaged components.

PRE-ALIGNMENT INSPECTION

Before any attempt is made to change or correct the wheel alignment factors the following inspection and necessary corrections must be made on those parts which influence the steering of the vehicle.

(1) Check and inflate tires to recommended pressure. All tires should be the same size and be in good condition and have approximately same wear. Note type of tire tread wear which will aid in diagnosing (Group 22).

(2) Check and adjust front wheel bearings.

(3) Check front wheel and tire assembly for radial and lateral runout (follow the Equipment Manufacturers Instruction (Group 22)).

(4) Check wheel and tire for unbalance conditions both static and dynamic which could affect steering.

(5) Inspect ball joints and all steering linkage pivot points for excessive looseness.

(6) Check shock absorbers for leaks and jounce vehicle to determine if shock absorbers have proper control.

(7) Check steering gear for roughness, binding or sticking condition and adjust as necessary.

(8) Check rear springs for cracks or broken leaves and U-bolts for proper tightness and measure height differential between left and right sides of vehicle. (Vehicle should be on level floor or on alignment rack) with a full tank of fuel and no luggage or passenger load.

To obtain accurate readings, vehicle should be jounced in following manner just prior to taking each measurement (Caster-Camber and Toe): Grasp bumpers at center (rear bumper first) and jounce up and down several times. Always release bumpers on the down cycle after jouncing both rear and front ends an equal number of times.

Front wheel alignment settings must be held to specifications to hold tire wear to a minimum and to maintain steering ease and handling of vehicle.

The equipment manufacturers recommended procedure should always be followed. Any parts of the front suspension system should be replaced if they are found to be bent. **Do not attempt to straighten any bent part.**

- (1) Prepare vehicle for measuring wheel alignment.
- (2) Remove all foreign material from exposed threads of cam adjusting bolts.
- (3) Record initial camber and caster readings before loosening cam bolt nuts.
- (4) Camber settings should be held as close as possible to the "preferred" setting. Caster should be held as nearly equal as possible on both wheels. See specifications.

The toe setting should be the final operation of the front wheel alignment adjustments. The front wheels must be in a straight ahead position. Follow the equipment manufacturers procedure. The steering wheel should also be centered during this operation.

Turning the tie rod sleeve will "center" the steering wheel spokes. If the steering wheel was centered, make the toe-in adjustment by turning both sleeves an equal amount.

LOWER CONTROL ARM STRUT

Removal

- (1) Raise vehicle on hoist.
- (2) Using a small drift and hammer, drive spring pin from front of strut. Remove spring pin, nut, retainer and bushing.
- (3) Remove rear mounting bolts along with the jounce bumper and bracket. Remove strut (Fig. 3).

Installation

- (1) Position retainer and bushing on strut.
- (2) Carefully slide strut into position. Install mounting bolts and tighten to 95 ft. lbs. (129 N-m).

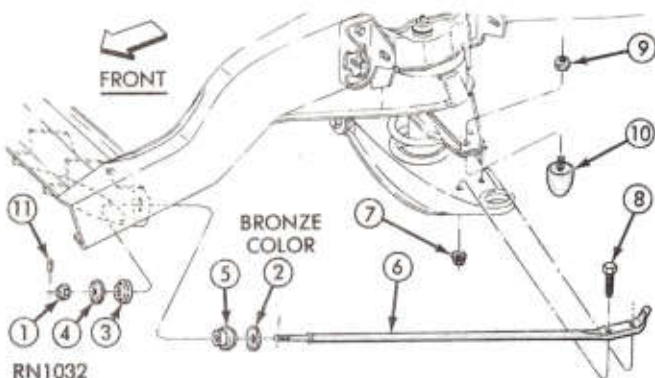


Fig. 3—Lower Control Arm Strut and Related Parts

LEGEND FIG. 3

- | | | |
|------------------|----------------|--------------------|
| 1—Nut | 5—Rear Bushing | 9—Nut |
| 2—Rear Retainer | 6—Strut | 10—Bumper Assembly |
| 3—Front Bushing | 7—Nut Assembly | 11—Spring Pin |
| 4—Front Retainer | 8—Bolt | |

- (3) Install bushing, retainer and nut at front of strut. Tighten nut to 50 ft. lbs. (68 N-m).

- (4) Install spring pin and lower vehicle.

SHOCK ABSORBER

Removal

- (1) Raise vehicle on hoist. Position jack stands on frame and lower front hoist.
- (2) Turn wheels in direction needed to give best possible access to upper shock absorber mount.
- (3) Remove upper nut and retainer.
- (4) Remove two lower mounting bolts and shock absorber.

Installation

- (1) Extend shock absorber fully, install retainer on shock absorber. Check upper bushing and sleeve to make sure they are in proper position and not worn or broken.
- (2) Carefully guide shock absorber up through coil spring and sleeve. Install top retainer and nut. Tighten to 25 ft. lbs. (34 N-m).
- (3) Align lower end of shock absorber and install mounting bolts. Tighten to 200 in. lbs. (23 N-m).
- (4) Raise hoist, remove jack stands and lower vehicle to ground.

FRONT COIL SPRINGS

Removal

- (1) Raise vehicle and install jack stands and lower hoist. Remove wheel and tire assembly.
- (2) Remove caliper retainer. Remove caliper from disc by sliding out and away from disc. Hang caliper out of the way. **Do not let caliper hang by hydraulic hose.**
- (3) Remove shock absorber upper nut and retainer, and two lower mounting bolts and remove shock absorber.
- (4) Remove spring pin from strut (bushing end), and loosen retaining nut. Disconnect sway bar at link (if so equipped).
- (5) Install spring compressor Tool DD-1278, tighten finger tight and then back off 1/2 turn.
- (6) Remove cotter keys and ball joint nuts.
- (7) Install ball joint breakers Tool C-3564-A, turn threaded portion of the tool to lock securely against the lower stud (Fig. 4). Spread the tool enough to place the lower stud under pressure then strike the steering knuckle sharply with a hammer to loosen the stud. **Do not attempt to force the stud out of the knuckle with the tool alone.**
- (8) Remove ball joint breaker tool. Slowly loosen the coil spring compressor until all tension is relieved from the spring. Remove spring compressor and spring.

Installation

(1) Position spring on control arm, install spring compressor. Compress spring until ball joint is properly positioned on steering knuckle.

(2) Install ball joint nuts, tighten to 135 ft. lbs. (189 N·m). Install cotter keys.

(3) Tighten bushing retainer nut (front end of strut) to 50 ft. lbs. and install spring pin.

(4) Connect, sway bar (if so equipped) and tighten link to 100 in. lbs. Remove spring compressor tool.

(5) Position shock absorber and install upper retainer and nut and tighten to 25 ft. lbs. (34 N·m). Install lower mounting bolts and tighten to 200 in. lbs. (23 N·m).

(6) Slowly slide caliper assembly into position in adaptor and over rotor. Align caliper on machined ways of adaptor. **Be careful not to pull the dust boot from its grooves as the piston and boot slide over the inboard shoe.**

(7) Install retaining clips and torque to 180 in. lbs. (20 N·m).

(8) Install and tighten wheel and tire assembly.

(9) Raise hoist remove jack stands, lower vehicle and test vehicle operation.

LOWER CONTROL ARM

Removal

(1) Follow procedure outlined under "Coil Spring Removal".

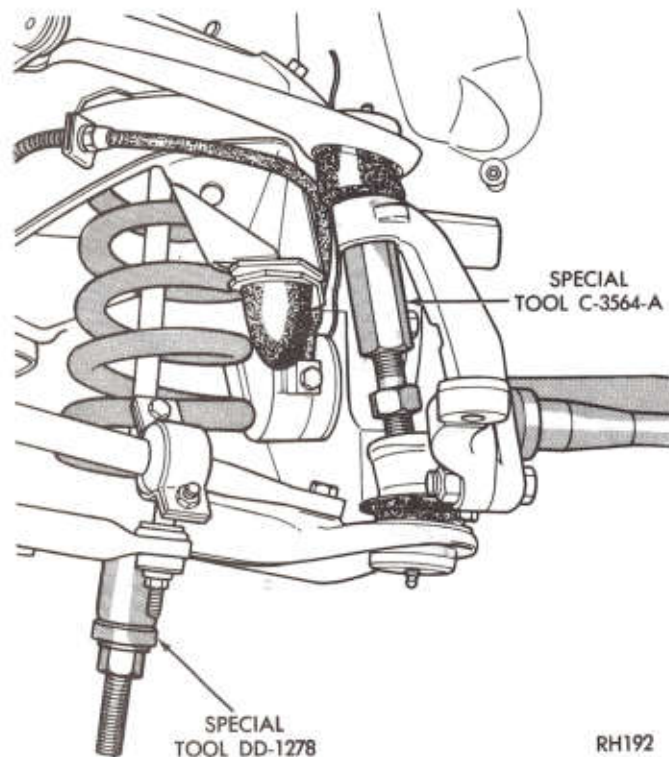


Fig. 4—Ball Joint Breaker and Spring Compressor Tools Installed

(2) Remove hex-head mounting bolt from the crossmember.

(3) Remove lower control arm from vehicle (Fig. 7).

Installation

(1) Position lower control arm on vehicle.

(2) Install hex-head mounting bolt, leave finger tight.

(3) Follow procedure outlined under "Coil Spring Installation".

(4) After vehicle has been lowered to a driving position tighten hex head mounting bolt to 225 ft. lbs. (305 N·m).

LOWER BALL JOINT

Removal

(1) Follow procedure outlined under "Coil Spring Removal".

(2) Remove ball joint seal. Use assembled Tool C-4212 to press ball joint out of lower control arm (Fig. 5).

Installation

(1) Press new ball joint into lower control arm using assembled Tool C-4212 (Fig. 6).

(2) Place a new seal over ball joint (if necessary), press retainer portion of seal down on ball joint housing, with a suitable size socket, until it is securely locked in position.

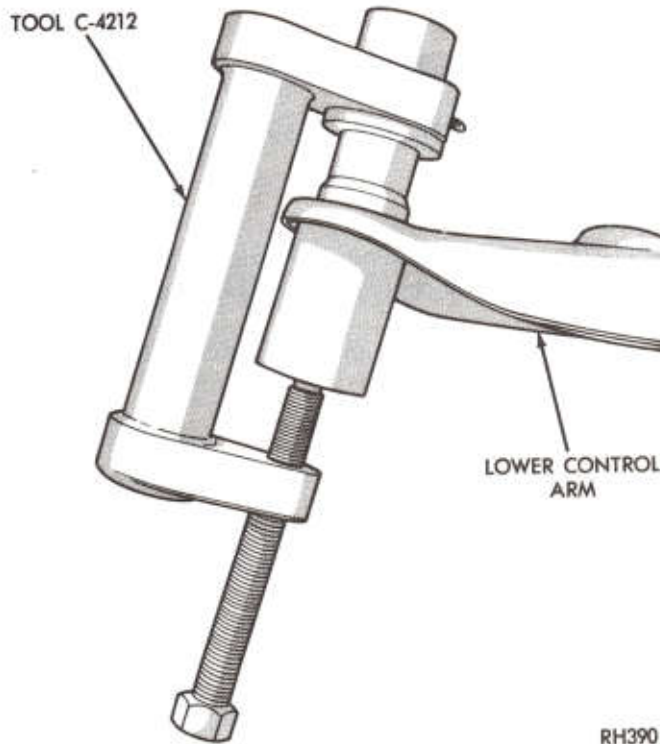


Fig. 5—Removing Lower Ball Joint

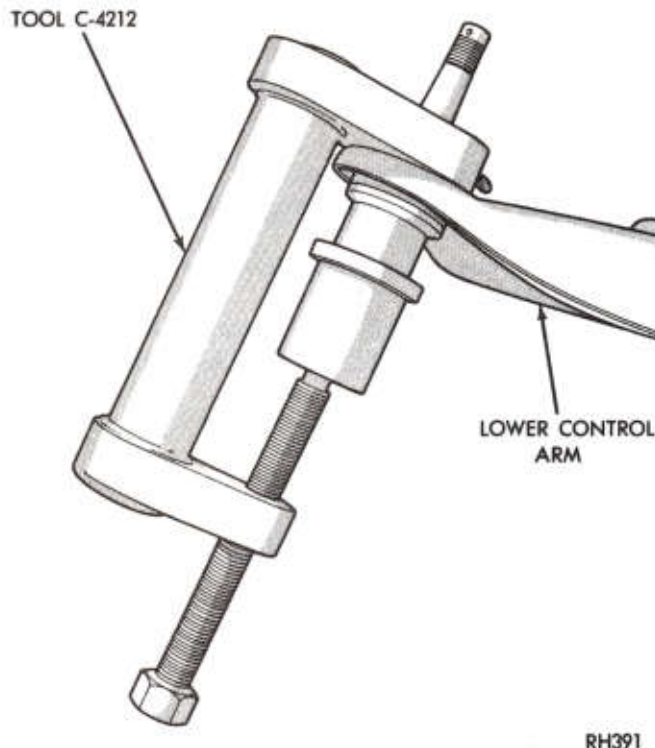


Fig. 6—Installing Lower Ball Joint

(3) Install control arm using procedure outlined under "Lower Control Arm Installation".

LOWER CONTROL ARM BUSHING

Removal

- (1) Follow procedure outlined under "Lower Control Arm Removal".
- (2) Using an arbor press and a suitable sleeve, press out old bushing.

Installation

- (1) Using an arbor press and a suitable sleeve, press new bushing into control arm. Make sure it is fully seated.
- (2) Follow procedure outlined under "Lower Control Arm Installation".

UPPER CONTROL ARM

Removal

- (1) Raise vehicle on hoist. Position jack stands on frame and lower front hoist. Remove wheel and tire assembly.
- (2) Remove shock absorber and upper shock absorber bushing and sleeve.
- (3) Install spring compressor (Tool DD-1278), tighten finger tight then back off 1/2 turn.
- (4) Remove cotter keys and ball joint nuts.
- (5) Install ball joint breaker Tool (C-3564-A) turn the threaded portion of the tool locking securely

against upper stud (Fig. 8). Spread the tool enough to place the upper stud under pressure, then strike the steering knuckle sharply with a hammer to loosen the stud. **Do not attempt to force the stud out of the knuckle with the tool alone.**

(6) Remove the tool. Remove the eccentric pivot bolts and the control arm (Fig. 9).

Installation

- (1) Position the control arm and install pivot bolts and nuts finger tight.
- (2) Install nuts on ball joints and tighten to 135 ft. lbs. (183 N·m). Install cotter keys.
- (3) Remove spring compressor tool.
- (4) Install upper shock absorber bushing and sleeve. Position shock absorber and install upper retainer and nut, and lower mounting bolts. Tighten to specifications.
- (5) Install wheel and tire assembly. Raise hoist, remove jack stands and lower vehicle to ground.
- (6) Adjust caster and camber (see specifications). Tighten eccentric pivot bolts to 70 ft. lbs. (95 N·m).

UPPER BALL JOINT

Removal

- (1) Place jack under outer end of lower control arm,

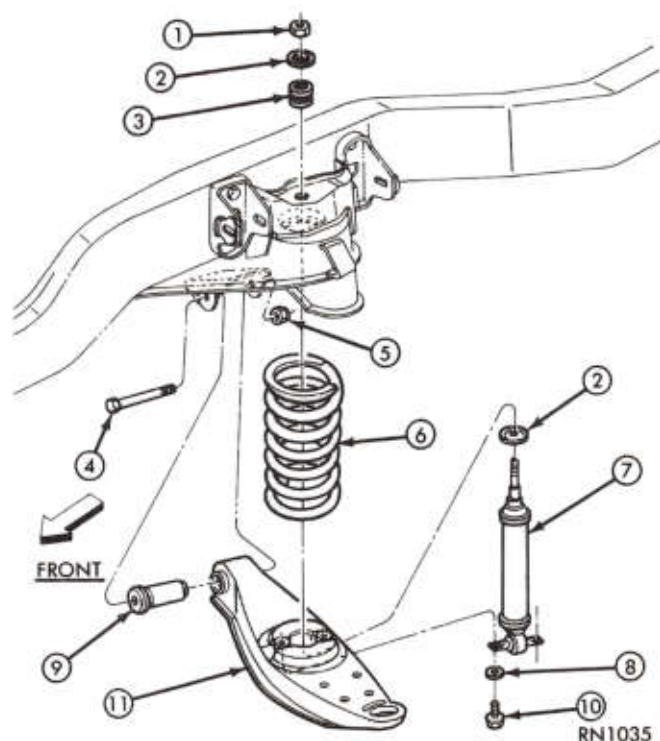


Fig. 7—Lower Control Arm and Related Parts

LEGEND FIG. 7

- | | | |
|------------|------------------|----------------------|
| 1—Nut | 5—Nut | 9—Bushing Assembly |
| 2—Retainer | 6—Coil Spring | 10—Capscrew |
| 3—Bushing | 7—Shock Absorber | 11—Lower Control Arm |
| 4—Bolt | 8—Washer | |

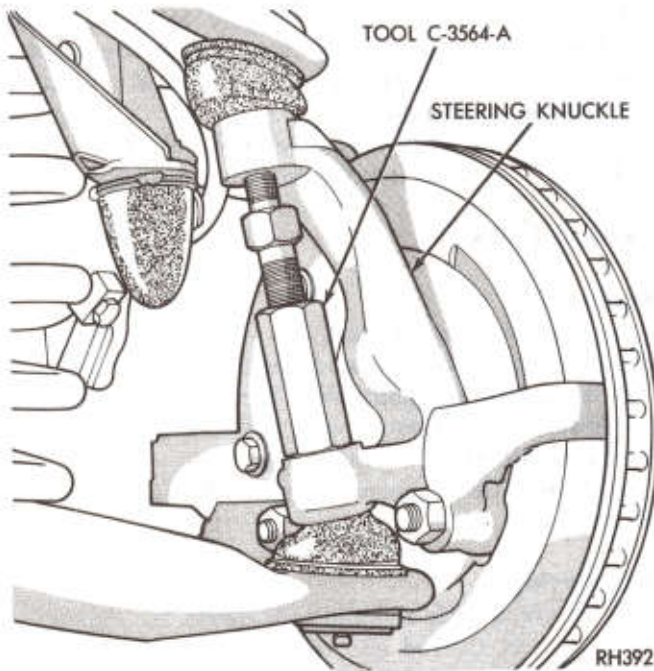


Fig. 8—Ball Joint Breaker Tool Installed

raise vehicle clear of floor.

- (2) Remove wheel and tire assembly.
- (3) Remove ball joint nuts. Using ball joint breaker (Tool C-3564-A) free upper ball joint (Fig. 8).
- (4) Using Tool C-3561 unscrew ball joint from control arm.

Installation

- (1) Screw new ball joint into control arm as far as possible by hand, then using Tool C-3561 tighten ball joint to 125 ft. lbs. (169 N-m). **Be sure ball joint is seated fully against arm.**
- (2) Install and seat new ball joint seal.

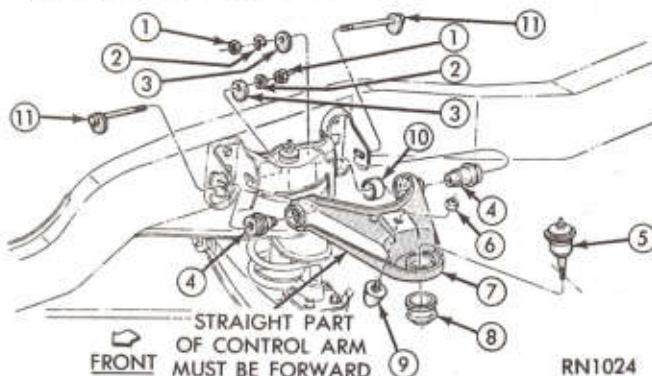


Fig. 9—Upper Control Arm (Disassembled View)

LEGEND FIG. 9

- | | |
|--------------------|--------------------------|
| 1—Nut | 7—Upper Control Arm |
| 2—Lockwasher | 8—Upper Ball Joint |
| 3—Cam | 9—Bumper Assembly |
| 4—Bushing Assembly | 10—Sleeve |
| 5—Ball Joint | 11—Cam and Bolt Assembly |
| 6—Lock Nut | |

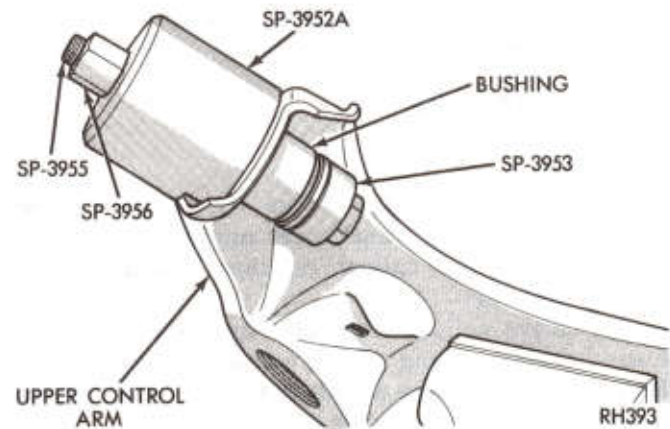


Fig. 10—Removing Upper Control Arm Bushing

- (3) Insert ball joint into steering knuckle, install ball joint nuts. Tighten to 135 ft. lbs. (183 N-m). Install cotter keys.
- (4) Install wheel and tire assembly. Lower vehicle to ground.

UPPER CONTROL ARM BUSHING

Removal

- (1) Follow procedure outlined under "Upper Control Arm Removal".
- (2) Place control arm in a vise and assemble Tool C-3962 and adapter SP-3953 (Fig. 10) over bushing, and press bushing out of arm.

Installation

When installing new bushings, be sure control arm is supported squarely at point where bushing is being pressed in. **Do not use oil or grease to aid in installation.**

- (1) Position flange end of new bushing in Tool C-3962, support control arm squarely, and press bushings into control arm (from outside) until tapered portion seats on the arm (Fig. 11).

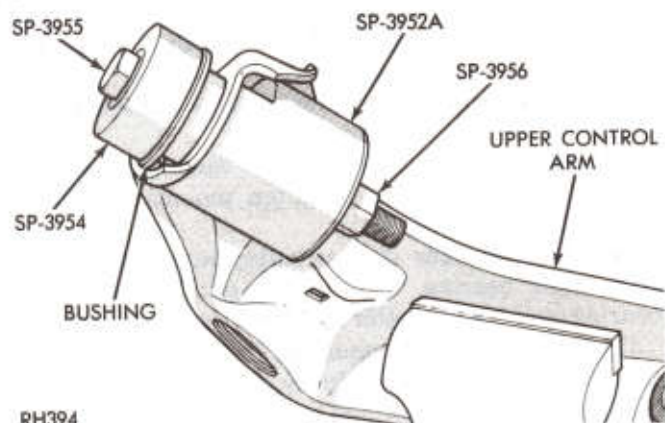


Fig. 11—Installing Upper Control Arm Bushing

(2) Follow procedure outlined under "Upper Control Arm Installation".

STEERING KNUCKLE

Removal

(1) Block brake pedal in the up position. Raise vehicle and remove wheel cover and wheel and tire assembly. Remove caliper retainer and anti-rattle spring assemblies.

(2) Remove caliper from disc by sliding out and away from disc. Hang caliper out of the way. **Do not let caliper hang or be supported by hydraulic brake hose.** Remove inboard shoe.

(3) Remove hub cap, cotter key, nut, washer, and outer bearing.

(4) Carefully slide disc assembly from steering knuckle. Do not drag seal or inner bearing over steering knuckle thread (thread, bearing and oil seal may be damaged). Remove splash shield and discard dust seal.

(5) Place jack under outer end of lower control arm.

(6) Disconnect tie rod at steering knuckle arm following procedure outlined under "Tie Rod End Removal".

(7) Separate steering knuckle and steering knuckle arm from ball joints following procedure outlined under "Upper Control Arm Removal" and "Lower Control Arm Removal". Place assembly on bench or floor.

(8) Remove mounting bolts holding brake adapter, steering knuckle arm and steering knuckle together. Separate components.

Installation

(1) Install brake adapter on steering knuckle and tighten mounting bolts to 100 ft. lbs. (136 N-m).

(2) Align steering knuckle arm to steering knuckle. Install mounting bolts and tighten to 215 ft. lbs. (291 N-m).

(3) Mount steering knuckle to control arms and install mounting nuts. Tighten to 135 ft. lbs. (183 N-m). Install cotter keys.

(4) Connect tie rod end. Install and tighten nut to 45 ft. lbs. Install cotter keys.

(5) Position new dust seal on steering knuckle. Install splash shield and tighten mounting bolts to 220 in. lbs. (25 N-m).

(6) Carefully slide disc assembly into position. Install outer bearing, washer and nut. Adjust wheel bearing and install cotter key, nut, and hub cap.

(7) Locate inboard shoe on adapter with shoe flanges in adapter ways. Slowly slide caliper assembly into position in adapter and over disc. Align caliper on machined ways of adapter. **Be careful not to pull the dust boot from its grooves as the piston and boot slide over the inboard shoe.**

(8) Install anti-rattle springs and retaining clips and torque to 180 in. lbs. (20 N-m). **The inboard shoe anti-rattle spring must always be installed on top of the retainer spring plate.**

(9) Install wheel and tire assembly and wheel cover.

(10) Remove jack, lower vehicle and test operation.

TIE ROD ENDS

Removal

(1) Raise vehicle on hoist.

(2) Remove cotter key and nut from tie rod end.

(3) Install tie rod end puller Tool C-3894A (Fig. 12). Apply sufficient pressure with tool to free tie rod end from knuckle arm or center link.

(4) Loosen tie rod sleeve clamping bolt and unscrew tie rod end.

Installation

(1) Screw new tie rod end into sleeve.

(2) Connect tie rod end to knuckle arm or center link. Install nut and tighten to 45 ft. lbs. (61 N-m). Install cotter key.

(3) Lower vehicle to floor and adjust toe-in (See Specifications).

(4) Position clamp on sleeve so that bolt and clamp opening is in line with slot in sleeve. Tighten clamp nut to 150 to 175 in. lbs. (17 to 20 N-m).

STEERING LINKAGE (Fig. 13)

The tie rod ends seals should be inspected for damage at all oil change periods.

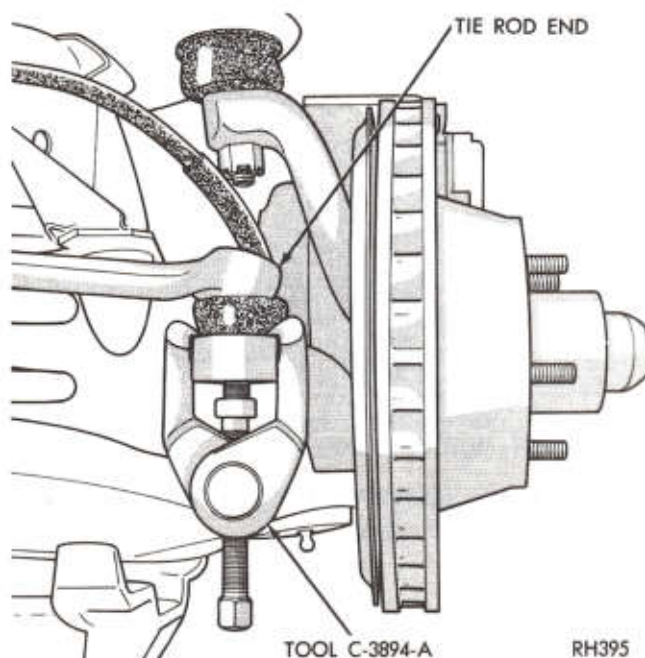


Fig. 12—Tie Rod End Puller Installed

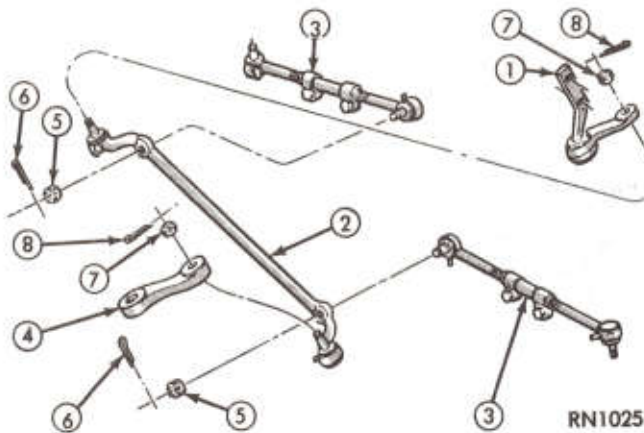


Fig. 13—Steering Linkage Assembly

LEGEND FIG. 13

1—Idler Arm and Bracket
2—Center Link Assembly
3—Tie Rod Assembly
4—Steering Gear Arm

5—Nut
6—Cotter Key
7—Nut
8—Cotter Key

Removal

Removal of tie rod ends from the steering knuckle arm or center link by methods other than using Tool C-3894-A will damage tie rod end seal.

When removing tie rod ends, idler arms or steering gear arm, all seals should be closely inspected for wear or damage.

Damaged seals require removal of the seals and inspection of tie rod assembly end at the throat opening. If the parts have not lost all the lubricant or are not contaminated, worn or rusted, use new seals and reinstall, otherwise, a new complete tie rod end assembly should be installed. Lubricate the tie rod end assembly with special long-life chassis greases such as Multi-Mileage Lubricant, Part Number 4318062 or equivalent.

- (1) Remove tie rod ends from steering knuckle arms (Fig. 13). **Use care not to damage seals.**
- (2) Remove inner tie rod-ends from center link.
- (3) Remove idler arm from center link.
- (4) Remove idler arm bracket from frame.
- (5) Remove steering gear arm from center link.
- (6) Remove steering arm from gear.

Installation

Replace all tie rod and steering arm assemblies that are damaged or worn.

(1) Position idler arm bracket on frame and install mounting bolts. Install idler arm, tighten nut to 40 ft. lbs. (54 N·m). Install cotter key.

(2) Position steering gear arm on gear and install washer and nut and tighten to 175 ft. lbs. (237 N·m).

CAUTION: Care must be exercised when installing

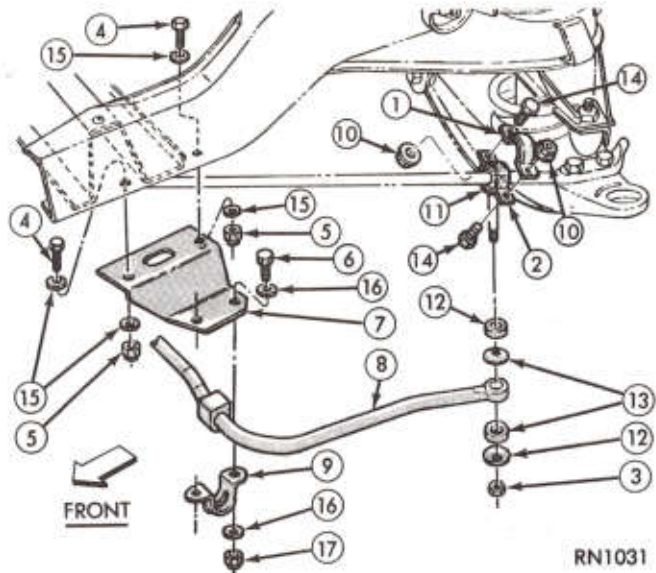


Fig. 14—Sway Bar and Related Parts

LEGEND FIG. 14

1—Retainer
2—Link Assembly
3—Nut
4—Bolt
5—Lock Nut
6—Bolt

7—Bracket
8—Shaft Assembly
9—Retainer
10—Nut
11—Insulator
12—Retainer

13—Insulator
14—Bolt
15—Coned Washer
16—Coned Washer
17—Lock Nut

center links. It is possible to install them back to front, which will result in incorrect geometry and tie rod to centerlink and tie rod to strut interferences in jounce. Viewed from the front of the vehicle, centerlink ends should bend up. Viewed from the side the ends should bend towards the front of the vehicle. Tie rod ball studs enter the centerlink from the rear.

(3) Install center link to idler arm and steering gear arm. Install nuts and tighten to 40 ft. lbs. (54 N·m). Install cotter keys.

(4) Connect tie rod ends to steering knuckle arms and center link. Tighten nuts to 45 ft. lbs. (61 N·m) and install cotter keys.

(5) Adjust toe-in (see specifications).

SWAY BAR (If So Equipped) (Fig. 14)

Removal

(1) Disconnect bar at each end link. Remove bolts from frame mounting brackets. Lower bar assembly from vehicle.

Installation

(1) Position bar to frame mounting brackets. Tighten bolts to 270 in. lbs. (31 N·m).

(2) Connect end links and tighten to 100 in. lbs. (11 N·m).

44-8FD FRONT AXLE

INDEX

	Page		Page
Axle Assembly		Drive Pinion Depth of Mesh Setting and Pinion	
Installation	23	Bearing Preload (Using Tool D-271)	27
Removal	22	Gear Tooth Contact Pattern	34
Left Axle Shaft (Disconnect) Assembly		General Information	10
Assembly and Installation	19	Lubrication	34
Removal and Disassembly	18	Service Diagnosis	12
Right Axle Shaft Assembly		Service Procedures	10
Installation	17	Specifications	55
Removal	17	Steering Knuckle Spindle and Ball Joint	
Braking Disc (Rotor) Hub or Bearings	10	Assembly and Installation	15
Differential Bearing Preload and Drive Gear and		Removal and Disassembly	11
Pinion Backlash	33	Steering Knuckle Arm	
Differential Case and Drive Pinion		Installation	21
Assembly and Installation	25	Removal	20
Removal and Disassembly	23	Sway Bar	
Disconnect Housing Assembly		Installation	22
Assembly and Installation	20	Removal	22
Removal and Disassembly	20	Tie Rod End	
Drag Link		Installation	22
Installation	21	Removal	22
Removal	21	Tightening Reference	56
Drive Pinion Depth of Mesh Setting and Pinion		Universal Joint Assembly	
Bearing Preload (Using Tool C-3715-B)	32	Disassembly and Assembly	18

GENERAL INFORMATION

CAUTION: Whenever front axle servicing is necessary, or axle is being rotated through use of the engine or other means, ELEVATE ALL FOUR WHEELS.

The 44-8FD axle is of the integral carrier housing, hypoid gear type in which the center line of the drive pinion is mounted below the center line of the ring gear.

The axle housing is an iron casting with tubular legs pressed into and welded to the carrier to form a carrier and tube assembly. A disconnect housing assembly is welded on the left axle tube, between the carrier and spring seat. A splined split axle shaft is used on the left side, and is mechanically connected or disconnected by a shift collar controlled by a vacuum operated shift fork (shift motor assembly). The shift motor assembly is activated by vacuum received from a switch on the transfer case. A removable stamped steel cover is bolted to the carrier to permit visual inspection of the differential without removing the complete axle from the vehicle.

A small metal tag is attached beneath one of the cover screws to identify the axle ratio. This tag is stamped with the number of teeth on the drive pinion

and ring gear and the axle ratio.

The drive pinion is supported by two preloaded taper roller bearings. The inner pinion bearing cone is a tight press-fit on the pinion stem. The outer pinion bearing is a light-press fit to a close-sliding fit on the pinion stem. The outer and inner bearing cups are a press-fit against a shoulder recessed in the carrier. The drive pinion depth of mesh adjustment is controlled by locating shims, which are installed between the inner pinion bearing cup and the carrier casting.

Drive pinion bearing preload is maintained by using different thicknesses of shim packs between the drive pinion bearing shoulder and outer pinion bearing cone.

The differential case is supported by two taper roller bearing cones which are a press-fit on the differential case hubs. Shims installed between the bearing cone and shoulder of hub of differential case, perform three functions: They eliminate the differential case side play; they adjust and maintain the backlash between the ring gear and drive pinion; and establish a means of obtaining differential bearing preload.

SERVICE PROCEDURES

BRAKING DISC (ROTOR) HUB OR BEARINGS

Removal and Disassembly

(1) Raise vehicle to a comfortable working height

and install jack stands. Remove wheel and tire assembly.

(2) Remove caliper retainer and anti-rattle spring assemblies. Remove caliper from braking disc by slid-

ing it out and away. Hang caliper out of the way. **Do not allow caliper to hang or be supported by hydraulic brake hose.** Remove inboard shoe.

(3) Remove the grease cap and driving hub snap ring.

(4) Remove driving hub and retaining spring.

(5) Using Tool C-4170-A, remove wheel bearing adjusting lock nut (Fig. 1). Remove lock nut, retaining washer, and wheel bearing adjusting nut (Fig. 2).

(6) Remove braking disc; outer wheel bearing and retainer spring plate will slide out as rotor is removed.

(7) Pry inner wheel bearing grease seal from hub and remove bearing cone.

(8) Remove inner and outer bearing cups.

Inspection

Wash bearings in clean mineral spirits, inspect and lubricate as described in lubrication section of this manual.

Reassembly and Installation

(1) Install inner and outer bearing cup in braking disc.

(2) Place lubricated inner bearing into position and using Tool D-359 and C-4171 Handle, install grease seal.

(3) Mount braking disc on spindle and position inner wheel bearing.

(4) Install inner locknut and using Tool C-4170, tighten to 50 ft. lbs. (68 N·m) to seat bearings. Loosen inner locknut and retighten to 30-40 ft. lbs. (41-54 N·m) while rotating hub. Back off inner locknut 135° to 150°. Position retaining washer by turning nut so that the pin pressed into the locknut will enter the nearest hole in the retaining washer. Install and

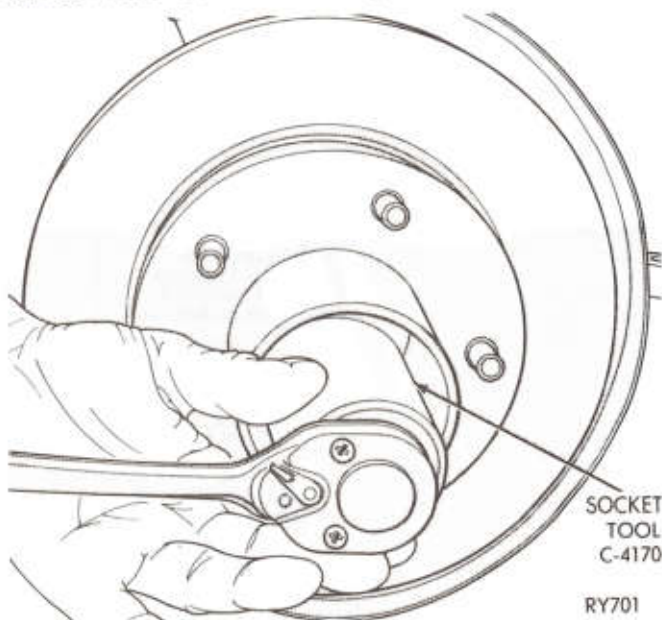


Fig. 1—Removing Wheel Bearing Adjusting Nut

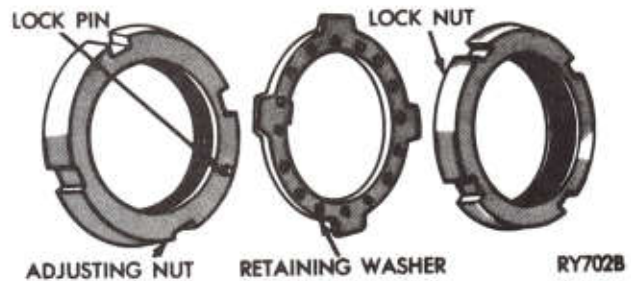


Fig. 2—Wheel Bearing Adjusting Nut, Retaining Washer, and Locknut

tighten outer locknut to 50 ft. lbs. (68 N·m). End play after final bearing adjustment will be within .001"-.010" (.03-.25mm).

(5) Install spacer, driving hub and snap ring.

(6) Apply RTV sealant on seating edge of grease cap and install.

(7) Locate inboard brake shoe on adapter with shoe flanges in adapter ways. Slowly slide caliper assembly into position in adapter and over braking disc. Align caliper on machined ways of adapter. **Be careful not to pull the dust boot from its grooves as the piston and boot slide over the inboard shoe.**

(8) Install anti-rattle springs and retaining clips and torque to 180 in. lbs. (20 N·m). **The inboard shoe anti-rattle spring must always be installed on top of the retainer spring plate.**

(9) Install wheel and tire assembly. Tighten nuts to 110 ft. lbs. (149 N·m). Install wheel covers. Remove jack stands, lower vehicle and test operation.

STEERING KNUCKLE, SPINDLE AND BALL JOINT

Removal and Disassembly

(1) Raise vehicle to a comfortable working height and install jack stands. Remove wheel and tire assembly.

(2) Remove caliper retainer and anti-rattle spring assemblies. Remove caliper from braking disc by sliding out and away. Hang caliper out of the way. **Do not allow caliper to hang or be supported by hydraulic brake hose.** Remove inboard shoe.

(3) Remove braking disc.

(4) Remove brake caliper adapter from the knuckle.

(5) Remove the six torque prevailing nuts and washers from the spindle to steering knuckle attaching bolts. Remove the brake splash shield.

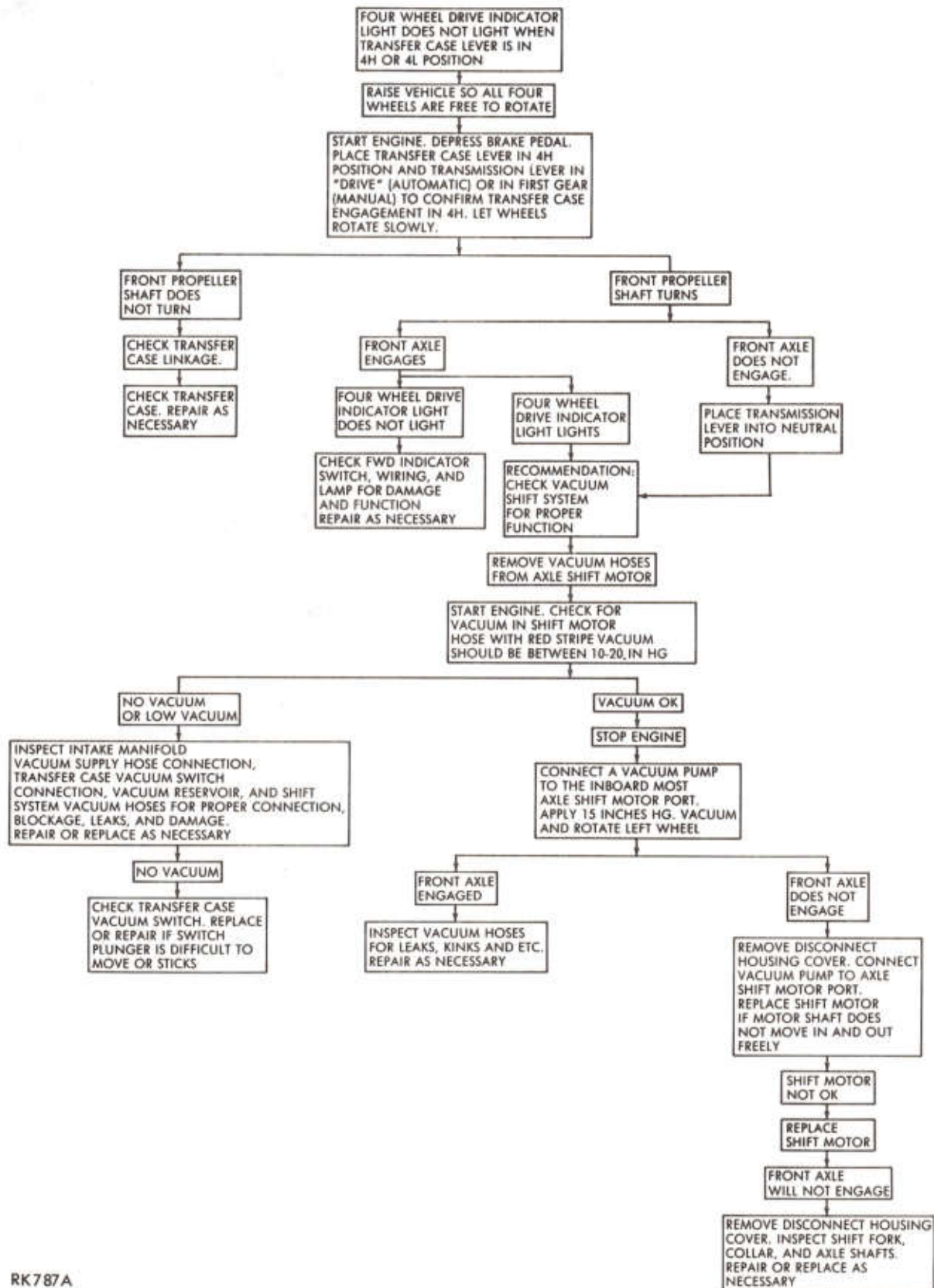
(6) Using a soft-faced hammer, hit spindle lightly to break it free from steering knuckle (Fig. 4).

(7) Place spindle in vise having soft jaws. Do not clamp on bearing carrying surfaces. Remove grease seal.

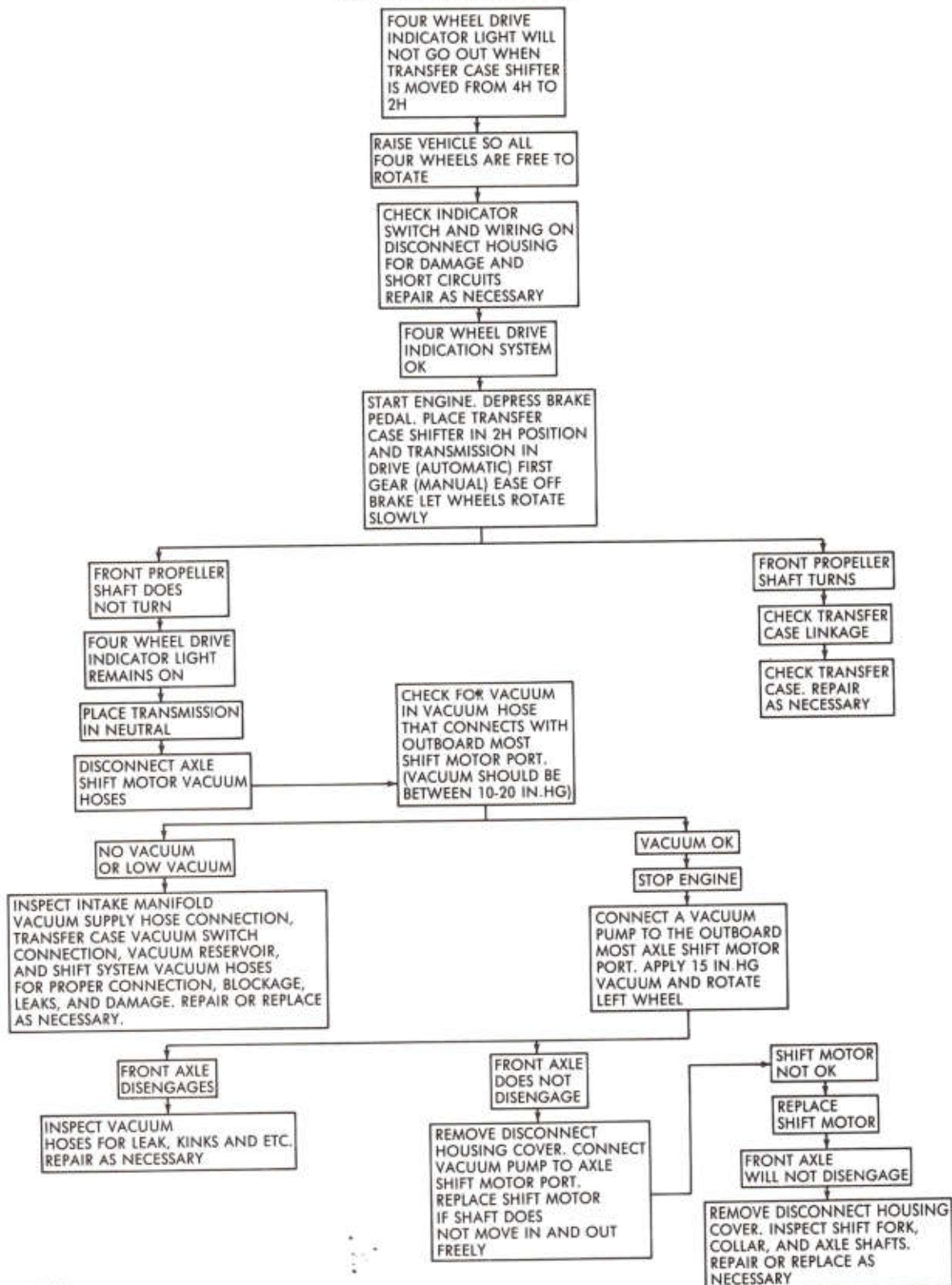
(8) Using Tool D-131 remove needle bearings from spindle (Fig. 5).

(9) Carefully remove the axle shaft assembly. Re-

DISCONNECT AXLE DIAGNOSIS CHART FOUR WHEEL DRIVE OPERATION



**DISCONNECT AXLE DIAGNOSIS CHART
TWO WHEEL DRIVE OPERATION**



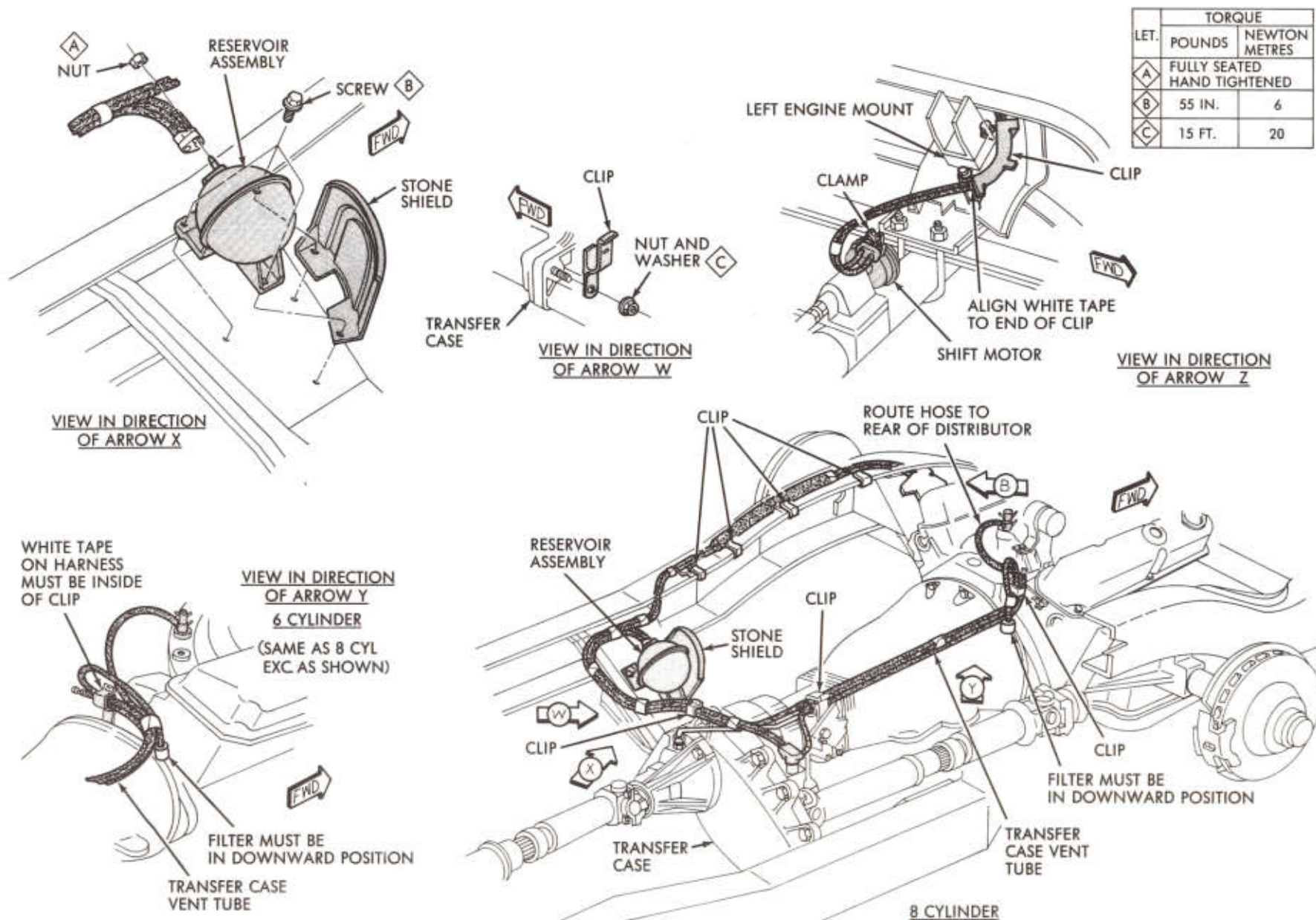
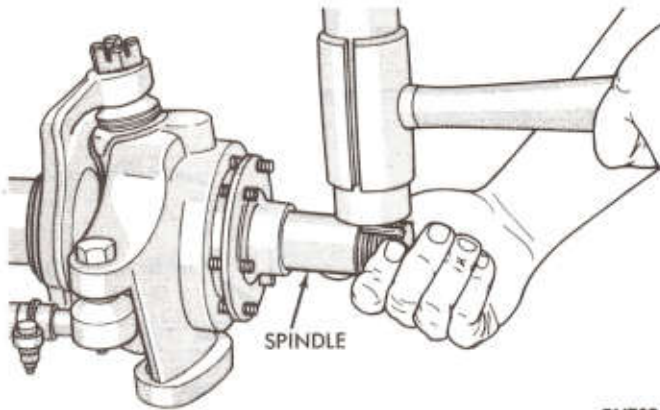


Fig. 3—Front Axle Disconnect Vacuum Hose Routing

RK 722



RY703

Fig. 4—Removing Spindle from Steering Knuckle

move seal from shaft.

(10) See "Tie Rod End" "Removal" in this group. Disconnect tie rod from steering knuckle. **Left Side**—Disconnect drag link from steering knuckle arm. See "Drag Link", "Removal" in this group.

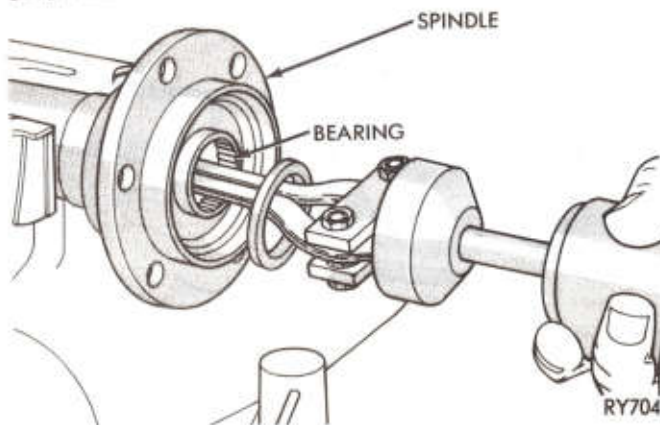
(11) **Left Side**—Remove nuts and cone washers from steering knuckle arm. Tap steering knuckle arm to loosen from knuckle. Remove steering knuckle arm.

(12) Remove cotter key from upper ball joint nut. Remove upper and lower ball joint nut. Discard lower nut.

(13) Using a brass drift and hammer, separate steering knuckle from axle housing yoke. Using Tool C-4169, remove and discard sleeve from upper ball joint yoke on axle housing.

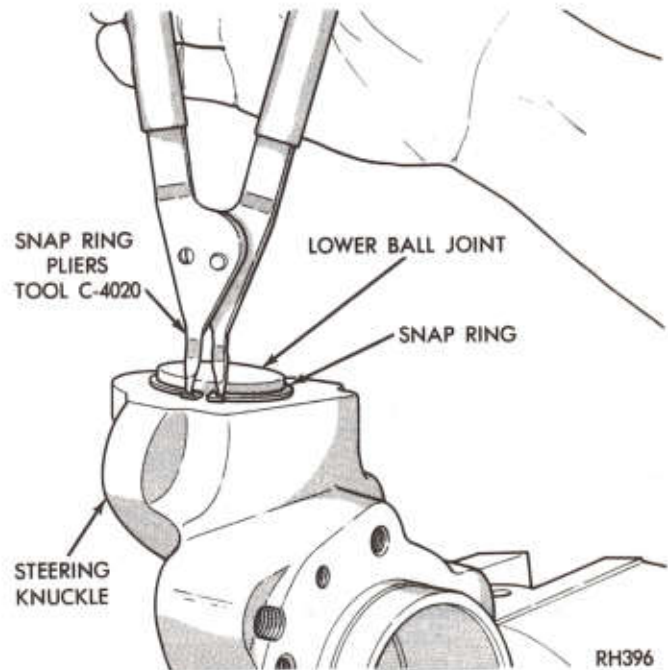
(14) Position steering knuckle upside down in a vise and remove snap ring from lower ball joint with Tool C-4020 snap ring pliers (Fig. 6).

(15) Using Tool C-4212-L and Adapter Set C-4288 positioned as shown in Figure 7, press lower ball joint from steering knuckle. Reposition tool as shown in Figure 8 and press upper ball joint from steering knuckle. Replace ball joints if any looseness or end play exists.



RY704

Fig. 5—Removing Needle Bearings from Right Spindle



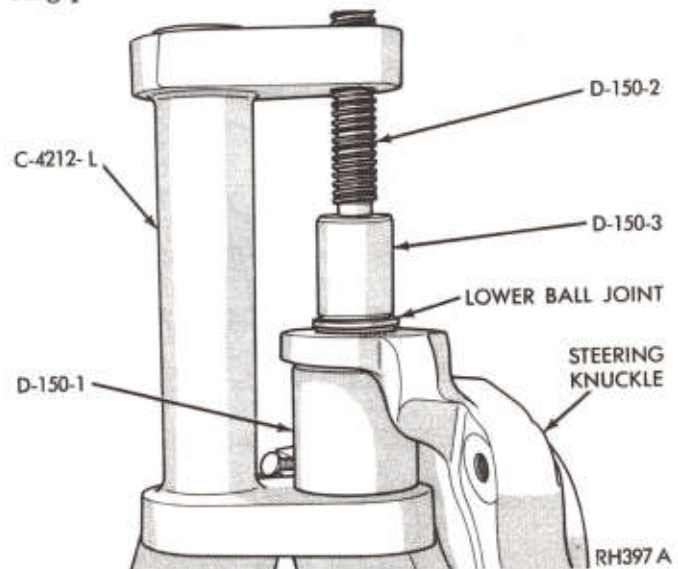
RH396

Fig. 6—Removing or Installing Snap Ring on Lower Ball Joint

(16) Clean all components with a suitable solvent and blow dry with compressed air. Inspect all parts for burrs, chips, wear or cracks. Replace necessary parts at assembly.

Assembly and Installation

(1) Position steering knuckle right side up in a vise. Using Tool C-4212-L and Adapter Set C-4288 positioned as shown in Figure 9 carefully press lower ball joint into position. Install snap ring with C-4020 snap ring pliers.



RH397 A

Fig. 7—Removing Lower Ball Joint from Steering Knuckle

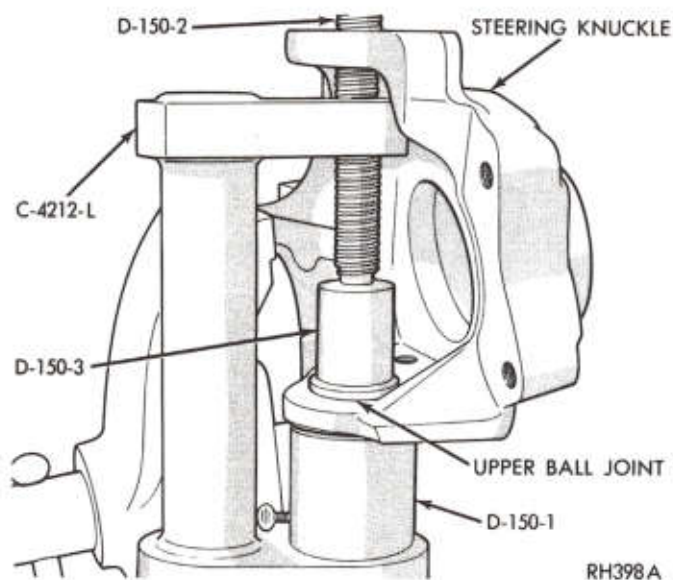


Fig. 8—Removing Upper Ball Joint from Steering Knuckle

(2) Using Tool C-4212-L and Adapter Set C-4288 positioned as shown in Figure 10, carefully press upper ball joint into position. Install new boots on both ball joints. Remove steering knuckle from vise.

(3) Screw new sleeve into upper ball joint yoke on axle housing leaving about two threads showing at the top.

(4) Position steering knuckle on axle housing yoke and install **New** lower ball joint nut. Tighten to 80 ft. lbs. (108 N·m).

(5) Using Tool C-4169 and a torque wrench, tighten sleeve in upper ball joint yoke to 40 ft. lbs. (54 N·m). Install upper ball joint nut and tighten to 100 ft. lbs.

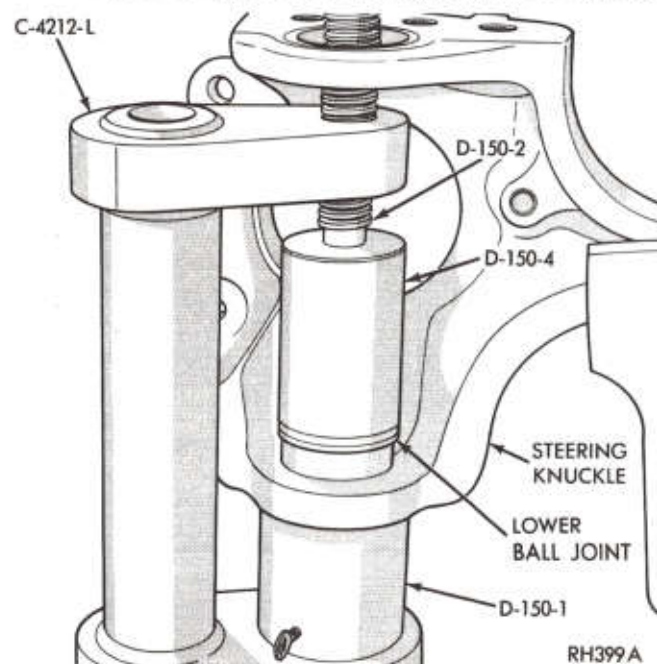


Fig. 9—Installing Lower Ball Joint

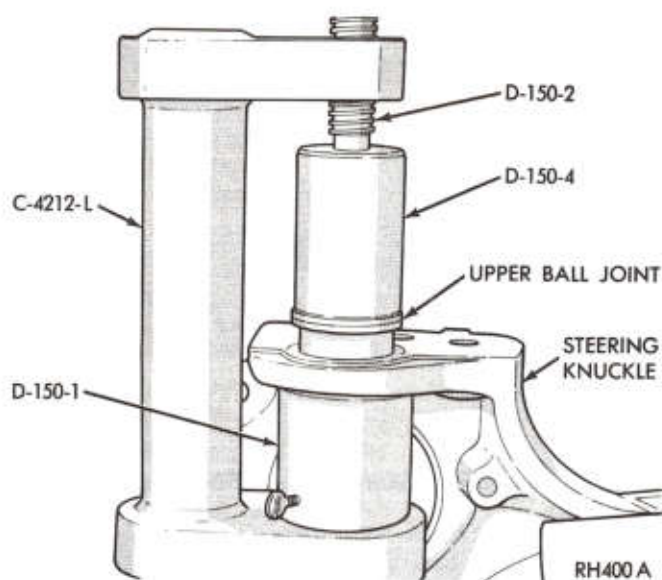


Fig. 10—Installing Upper Ball Joint

(136 N·m). Align cotter key hole in stud with slot in castellated nut, if slot and hole are not aligned continue to tighten nut until aligned. **Do not loosen to align.** Install cotter key.

(6) **Left Side**—Position steering knuckle arm over studs on steering knuckle. Install cone washer and nuts. Tighten nuts to 90 ft. lbs. (122 N·m). Assemble drag link to steering knuckle arm. Install nut and tighten to 60 ft. lbs. (81 N·m). Install cotter key.

(7) Assemble tie rod end to steering knuckle. Install nut and tighten to 45 ft. lbs. (61 N·m). Install cotter key.

(8) Install lip seal on the stone shield with the lip toward the axle shaft spline (Fig. 11). Lubricate the full circumference of the seal with Multi-purpose grease NLG1 Grade 2 EP or equivalent (Fig. 12).

(9) **Right Side**—Carefully insert axle shaft into the housing so as not to damage the differential seal.

(10) **Left Side**—Proceed as follows:

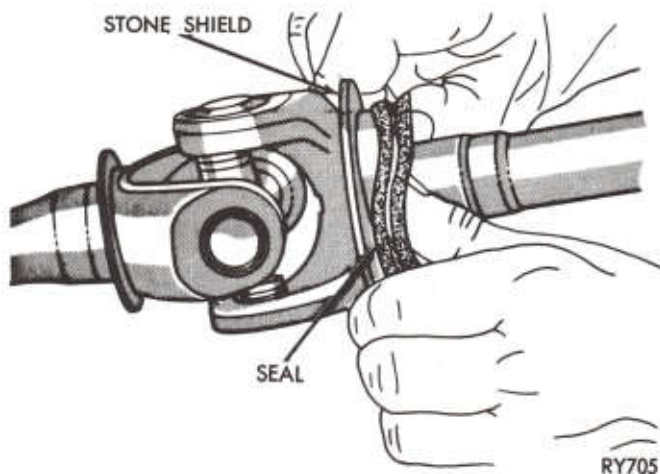


Fig. 11—Installing Lip Seal on Axle Shaft Stone Shield

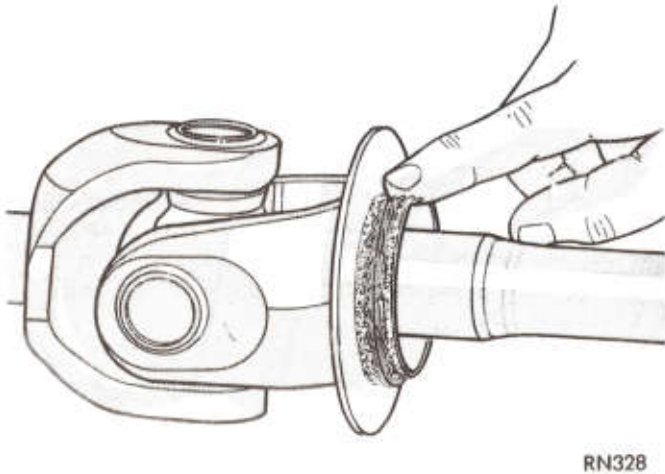


Fig. 12—Lubricating Lip Seal

- (a) Remove disconnect housing cover.
- (b) Position shift collar onto splined end of inner axle shaft.
- (c) Install intermediate axle shaft through axle shaft seal. **Care must be taken not to damage seal during this operation.**
- (d) Install disconnect housing cover assembly and gasket. **Be sure to guide shift fork into groove of shift collar.**
- (e) Install disconnect cover shield and bolts, tighten to 10 ft. lbs. (14 N·m).
- (f) Connect vacuum lines and wire to switch on disconnect housing assembly, wrap retention clip securely around switch connector.
- (11) Assemble new needle bearings into spindle using Tool D-122 Installer and C-4171 handle.
- (12) Using Tool D-155 and C-4171 handle, install new brake hub seal. Lubricate the full circumference of the seal and thrust surface of spindle with Multi-purpose Grease NLG1 Grade 2 EP or equivalent.
- (13) Position new spacer on axle shaft, install spindle and brake splash shield.
- (14) Install new nuts, tighten to 25-35 ft. lbs. (34-41 N·m).
- (15) Mount braking disc assembly and outer wheel bearing cone onto spindle.
- (16) Install wheel bearing nuts and locking washer; tighten as noted in "Braking Disc (Rotor) Hub and Bearings".
- (17) Install spring retainer, spring, drive gear, and snap ring.
- (18) Apply RTV sealant to the seating edge of the grease cap, then install.
- (19) Install brake adapter and tighten mounting bolts to 85 ft. lbs. (115 N·m).
- (20) Locate inboard brake shoe on adapter with shoe flanges in adapter ways. Slowly slide caliper assembly into position in adapter and over braking disc. Align caliper on machined ways of adapter. **Be**

careful not to pull the dust boot from its grooves as the piston and boot slide over the inboard shoe.

(21) Install anti-rattle springs and retaining clips and torque to 180 in. lbs. (20 N·m): **The inboard shoe anti-rattle spring must always be installed on top of the retainer spring plate.**

(22) Install wheel and tire assembly. Tighten nuts to specifications. Install wheel covers. Remove jack stands, lower vehicle and test operation.

RIGHT AXLE SHAFT ASSEMBLY

Removal

(1) Raise vehicle to a comfortable working height and install jack stands. Remove wheel and tire assembly.

(2) Remove caliper retainer and anti-rattle spring assemblies. Remove caliper from braking disc by sliding out and away from disc. Hang caliper out of the way. **Do not allow caliper to hang or be supported by hydraulic brake hose.** Remove inboard shoe.

(3) Remove braking disc.

(4) Remove six nuts which fasten splash shield and spindle to knuckle.

(5) Remove splash shield and spindle.

(6) Remove brake caliper adapter from knuckle.

(7) Carefully remove the axle shaft assembly. Remove seal and stone shield from shaft.

Installation

(1) Install lip seal on the axle shaft stone shield with the lip toward the axle shaft spline.

(2) Carefully insert axle shaft into the housing so as not to damage the differential seal at the side gears.

(3) Install spindle and splash shield. Install nuts and tighten to 25-30 ft. lbs. (34-41 N·m).

(4) Install the braking disc, outer bearing, nut, washer and locknut onto spindle. Tighten as specified.

(5) Install spacer, drive gear and drive gear snap ring.

(6) Apply RTV sealant on seating edge of grease cap and install.

(7) Install brake adapter and tighten mounting bolts to 85 ft. lbs. (115 N·m).

(8) Position inboard brake shoe on adapter with shoe flanges in adapter ways. Slowly slide caliper assembly into position in adapter and over braking disc. Align caliper on machined ways of adapter. **Be careful not to pull the dust boot from its grooves as the piston and boot slide over the inboard shoe.**

(9) Install anti-rattle springs and retaining clips and torque to 180 in. lbs. (20 N·m). **The inboard shoe anti-rattle spring must always be installed on top of the retainer spring plate.**

(10) Install wheel and tire assembly. Tighten nuts to specifications. Install wheel covers. Remove jack stands, lower vehicle and test operation.

UNIVERSAL JOINT ASSEMBLY

Disassembly

(1) Remove the snap rings from the two ears in each yoke.

(2) Position joint assembly in an open vise with one yoke "horizontal" and resting on top of vise jaws (Fig. 13). Do not tighten vise.

(3) With a mallet, tap upper ear of "vertical" yoke several times, driving vertical yoke down pushing out upper needle bearing and cap.

(4) Reverse yoke and remove opposite needle bearing and cap.

(5) Work yoke off arms of cross.

(6) To complete disassembly, position open ends of cross between soft jaws of vise and repeat steps 3 and 4 to remove remaining bearings and cap.

(7) Work cross free from yoke.

(8) Clean and inspect all parts. Clean any rust from axle shaft splines. **Keep each bearing and cap assembly separate.** If any component parts are worn or damaged a complete new joint assembly should be installed.

(9) Repack joint with MOPAR Multi-Mileage Lubricant Part No. 4318062 or equivalent.

Assembly

(1) Insert needle bearing and cap assembly in one ear of yoke.

(2) Place yoke in vise (Fig. 14) and press needle bearing cap into proper position. Install snap ring.

(3) Remove yoke from vise and work one arm of cross into it. Insert opposite bearing cap by hand and line it up with cross.

(4) Replace yoke in vise and press cap into yoke and onto arm of cross (Fig. 15).

(5) With aid of a short plug or socket, press bearing cap into proper position. Install snap ring.

(6) Repeat procedure as outlined in items 1 through 5 for installing remaining caps and yoke.

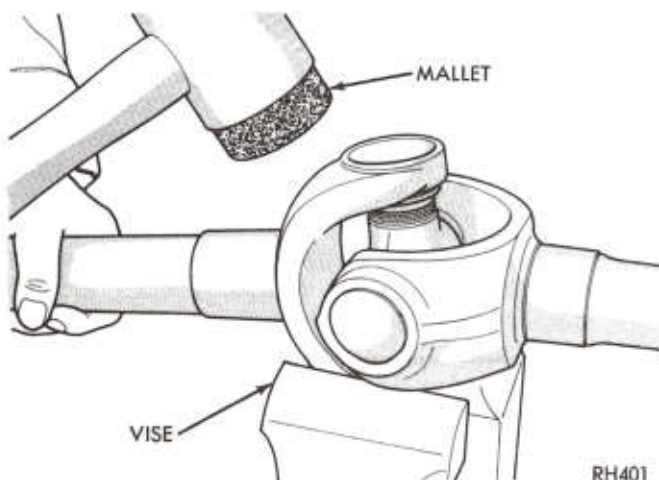


Fig. 13—Removing Bearing Caps

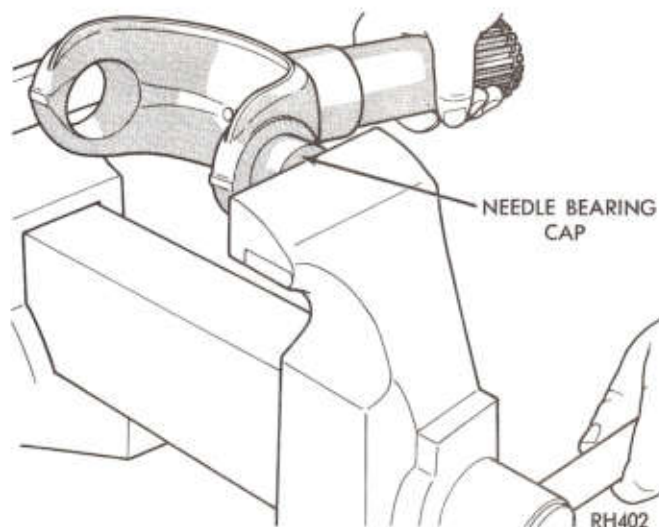


Fig. 14—Replacing Bearing Caps
LEFT AXLE SHAFT (DISCONNECT) ASSEMBLY

Removal and Disassembly

(1) Raise vehicle to a comfortable working height and install jack stands. Remove wheel and tire assembly.

(2) Remove caliper retainer and anti-rattle spring assemblies. Remove caliper from braking disc by sliding out and away. Hang caliper out of the way. **Do not allow caliper to hang or be supported by hydraulic brake hose.** Remove inboard shoe.

(3) Remove braking disc. See "Braking Disc (Rotor) Hub and Bearings", removal and disassembly.

(4) Remove nuts which fasten splash shield and spindle to knuckle.

(5) Remove splash shield and spindle.

(6) Disconnect vacuum lines and wire from switch on disconnect housing assembly.

(7) Remove disconnect housing cover assembly, gasket and shield (Fig. 16).

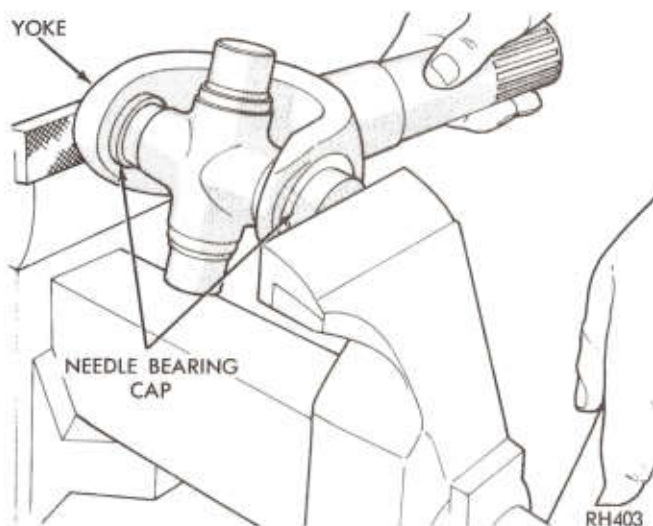


Fig. 15—Pressing Cross and Cap into Yoke

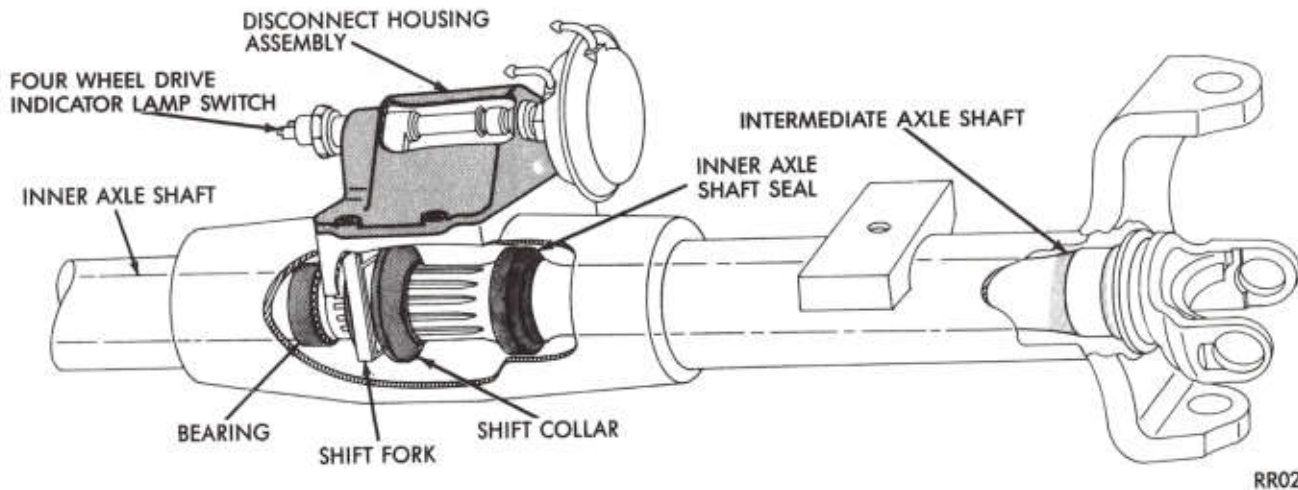
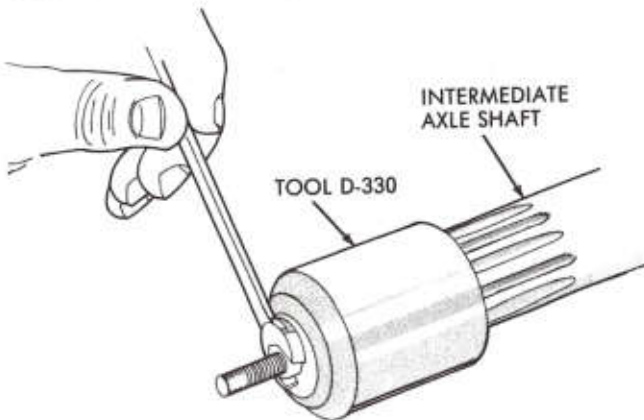


Fig 16—Disconnect Axle Housing Assembly

- (8) Remove intermediate axle shaft. **Carefully slide shaft through axle shaft seal to avoid damage to seal.**
- (9) Remove shift collar from disconnect housing.
- (10) Drive out inner axle shaft seal and remove from disconnect housing. Some vehicles may have a seal and guard; discard both pieces. **Guard is not used with new seal assembly.** Always replace the inner axle shaft seal whenever an axle shaft is removed from the axle housing.
- (11) Remove needle bearing from intermediate axle shaft with Tool D-330. (Figs. 17 & 18).
- (12) Loosen and remove differential cover screws and remove cover, drain lubricant into a container.
- (13) Push inner axle shaft toward center of vehicle and remove the "C" lock from recessed groove on shaft.
- (14) Using Tool D-354-4 and adapter D-354-3, remove inner axle shaft (Fig. 19).
- (15) Using Tool D-354-4, D-354-1, and Puller C-637, remove the inner axle shaft bearing (Figs. 16 and 18).

Assembly and Installation

- (1) Using Tool D-354-4, D-354-2 and C-637, install inner axle shaft bearing (Figs. 16 & 18).



RK 724

Fig. 17—Removing Bearing from Intermediate Shaft

- (2) Position inner axle shaft into axle housing using Tool D-354-4 and adapter D-354-3 (Fig. 19). Carefully slide axle shaft in place, install "C" lock in recessed groove of axle shaft.

- (3) Inspect inner axle shaft seal mounting surface and remove any material that may have remained in bore after old seal was removed. Clean outer axle bore with crocus cloth to remove rust from area where tool for installing inner axle shaft seal will be mounted.

- (4) Mount new axle shaft seal on Tool 5041-1 and position assembly in disconnect housing. Screw threaded bar (5041-2) through seal into Tool 5041-1. Place Tool 5041-3 and nut on end of bar and tighten until tool reaches shoulder of bar.

- (5) Install shift collar onto the splined end of inner axle shaft.

- (6) Install needle bearing into intermediate shaft using Tool D-328 and handle C-4171. (Fig. 20).

- (7) Lubricate splined end of intermediate axle shaft with a liberal amount of Multi-Purpose Lubricant, install through inner axle seal, **Care must be taken not to damage seal during this operation.**

- (8) Install disconnect housing cover assembly and gasket. **BE SURE TO GUIDE THE SHIFT FORK INTO THE GROOVE OF SHIFT COLLAR.**

- (9) Install disconnect housing cover shield and bolts, tighten to 10 ft. lbs. (14 N·m).

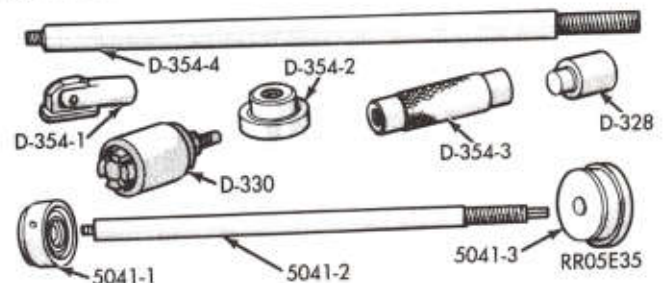


Fig. 18—Disconnecting Axle Housing Special Service Tools

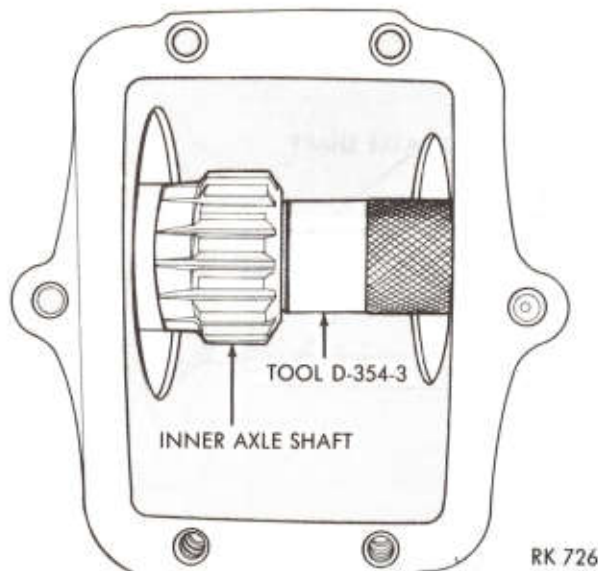


Fig. 19—Removing or Installing Inner Axle Shaft

(10) Connect vacuum lines and wire to switch on disconnect housing cover assembly. Wrap clip securely around four-wheel-drive indicator switch connector.

(11) Install the splash shield and spindle. Install the washers and new nuts. Tighten nuts to 25-30 ft. lbs. (34-41 N·m).

(12) Install braking disc, outer bearing, nut, washer, and locknut onto spindle. Tighten as noted in "Braking Disc (Rotor) Hub and Bearings", reassembly and installation.

(13) Install spacer, drive gear and drive gear snap ring.

(14) Apply RTV sealant on seating edge of cap and install.

(15) Position inboard brake shoe on adapter with shoe flanges in adapter ways. Slowly slide caliper assembly into position in adapter and over braking disc. Align caliper on machined ways of adapter. **Be careful not to pull the dust boot from its grooves as the piston and boot slide over the inboard shoe.**

(16) Install anti-rattle springs and retaining clips and torque to 180 in. lbs. (20 N·m). **The inboard shoe**

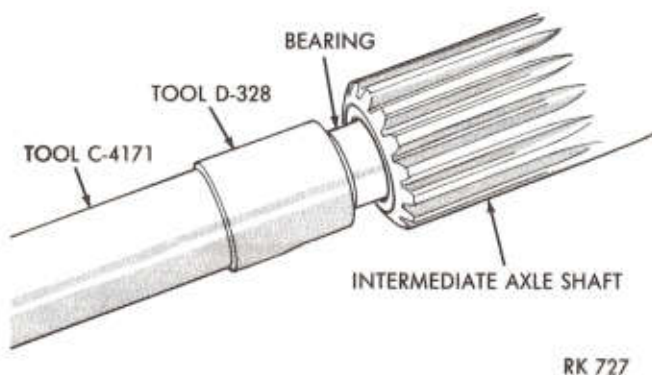


Fig. 20—Installing Bearing into Intermediate Shaft

anti-rattle spring must always be installed on top of the retainer spring plate.

(17) Scrape gasket material from differential cover and carrier face, thoroughly clean surface with mineral spirits or equivalent and dry completely. Apply a 1/16 inch to 3/32 inch bead of Mopar Silicone Rubber Sealant, Part Number 4318025, or equivalent, along bolt circle of the cover.

Allow sealant to cure while cleaning carrier gasket flange with mineral spirits or equivalent. Dry surface completely. Install cover on axle and torque cover screws to 30-40 ft. lbs. (41-54 N·m).

If for any reason cover is not installed within 20 minutes after applying sealant, sealant should be removed and a new bead applied.

(18) Remove fill plug and fill axle with proper lubricant. See "Lubrication and Maintenance" Group 0 of this manual for proper level and type of lubricant required.

(19) Install wheel and tire assembly. Tighten nuts to specifications. Install wheel covers. Remove jack stands, lower vehicle and test drive.

DISCONNECT HOUSING COVER ASSEMBLY

Removal and Disassembly

(1) Raise vehicle to a comfortable working height and install jack stands.

(2) Disconnect vacuum lines and wire from switch.

(3) Remove disconnect housing cover assembly, gasket, and shield from axle housing.

(4) Remove E-clips from shift motor housing and shaft and remove shift motor and shift fork (Fig. 21).

(5) Remove O-ring from shift motor shaft.

(6) Clean and inspect parts. If any component part is worn or damaged, it should be replaced.

Assembly and Installation

(1) Install new O-ring on shift motor.

(2) Install shift motor into disconnect housing and through shift fork. **Shift fork offset should be toward differential.**

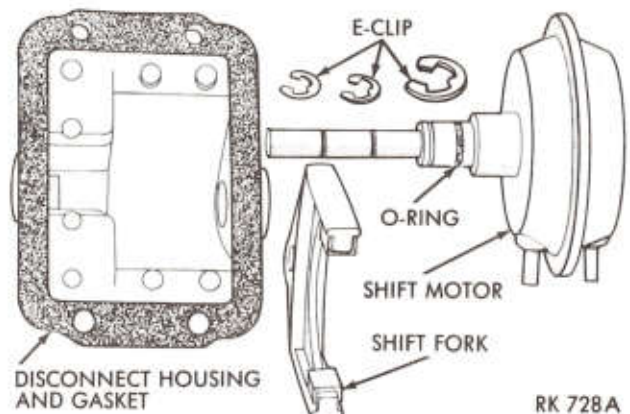


Fig. 21—Disconnect Housing Cover Assembly (Disassembled)

(3) Install E-clips on shift motor housing and shaft.
 (4) Install disconnect housing cover assembly and gasket. **Be sure to guide the shift fork into groove of shift collar.**

(5) Install disconnect housing assembly shield and bolts, tighten to 10 ft. lbs. (14 N·m).

STEERING KNUCKLE ARM

Removal

(1) Raise vehicle to a comfortable height and install jack stands.

(2) Turn wheels to the left. Remove cotter key and nut and disconnect drag links. See "Drag Link", "Removal" in this group.

(3) Remove three steering knuckle arm to steering knuckle mounting nuts and cone washers (Fig. 22). Tap steering knuckle arm to loosen. Remove steering knuckle arm.

Installation

(1) Position steering knuckle arm on steering knuckle. Install cone washers and nuts. Tighten nuts to 90 ft. lbs. (122 N·m).

(2) Install drag link to steering knuckle arm. Install nut and tighten to 60 ft. lbs. (81 N·m). Install cotter key.

(3) Remove jack stands. Lower vehicle and test operation.

DRAG LINK

Drag link seals should be inspected for damage at all oil change periods.

Damaged seals require removal of the seals and inspection of the drag link assembly at the throat opening. If the parts have not lost all the lubricant or are not contaminated, worn or rusted, use new seals

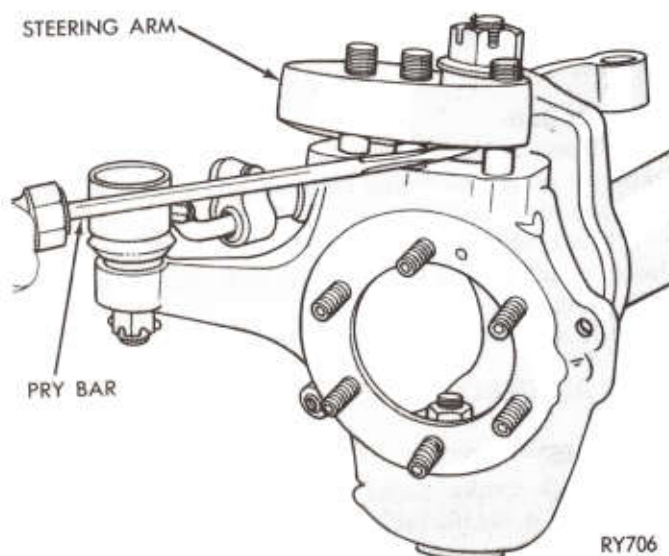


Fig. 22—Removing Steering Knuckle Arm

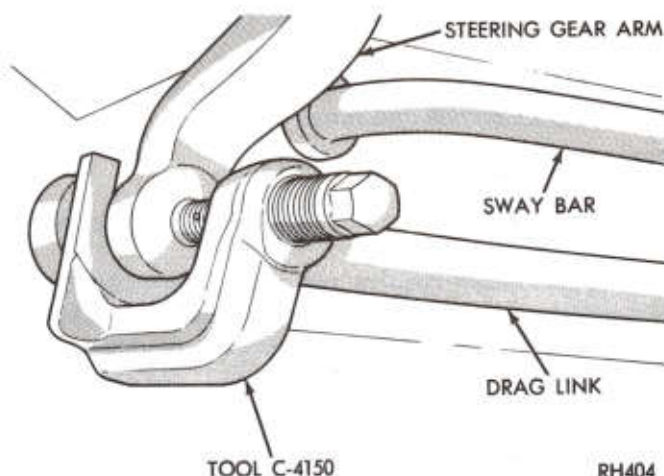


Fig. 23—Removing Drag Link with Tool C-4150

and reinstall, otherwise a new complete drag link assembly should be installed. Lubricate after assembly with **MOPAR** Multi-Mileage Lubricant Part Number 4318062 or equivalent.

Removal

Removal of drag link from steering knuckle arm or steering gear arm by methods other than using Tool C-4150 could damage seals.

(1) Raise vehicle to a comfortable working height and install jack stands. Remove wheel cover and wheel and tire assembly.

(2) Turn wheels in direction necessary to give best possible access to drag link. Remove cotter keys and nuts.

(3) Install puller Tool C-4150 (Fig. 23). Apply sufficient pressure with tool to free drag link from steering knuckle arm and steering gear arm. Lower drag link from vehicle.

Installation

(1) Position drag link to steering knuckle arm (Fig. 24) so that from production bend in arm to steering knuckle arm is the short distance marked as "A" and long distance from bend marked "B" is to be installed to steering gear arm.

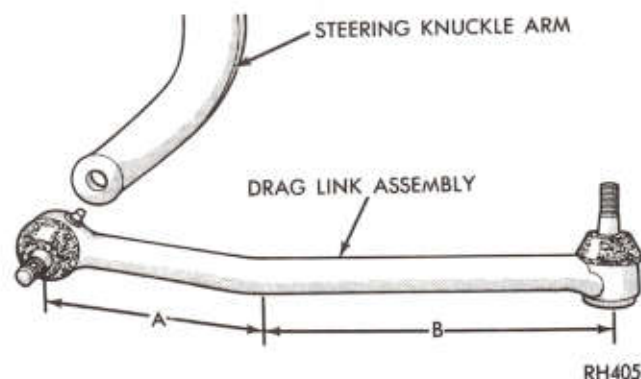


Fig. 24—Proper Installation of Drag Link Assembly

(2) Install and tighten nuts to 60 ft. lbs. (81 N·m). Install cotter keys.

(3) Install wheel and tire assembly and wheel cover. Remove jack stands and lower vehicle.

TIE ROD END

Tie rod end seals should be inspected for damage at all oil change periods.

Damaged seals require removal of the seals and inspection of the tie rod end assembly at the throat opening. If the parts have not lost all the lubricant or are not contaminated, worn or rusted, use new seals and reinstall, otherwise a new complete tie rod end assembly should be installed. Lubricate after assembly with MOPAR Multi-Mileage Lubricant Part Number 4318062 or equivalent.

Removal

Removal of tie rod end assembly from steering knuckle by methods other than using Tool C-3894-A could damage seals.

(1) Raise vehicle to a comfortable working height and install jack stands.

(2) Turn wheels in direction necessary to give best possible access to tie rod end. Remove cotter key and nut. Loosen clamping bolt nut.

(3) Install puller Tool C-3894-A (Fig. 25). Apply sufficient pressure with tool to free tie rod end from steering knuckle. Measure and record approximate distance from end of tie rod to outside edge of tie rod end. Unscrew tie rod end.

Installation

(1) Screw new tie rod end into tie rod to approximate distance previously recorded.

(2) Connect tie rod end to steering knuckle and install nut. Tighten to 45 ft. lbs. (61 N·m). Remove jack stands and lower vehicle to floor.

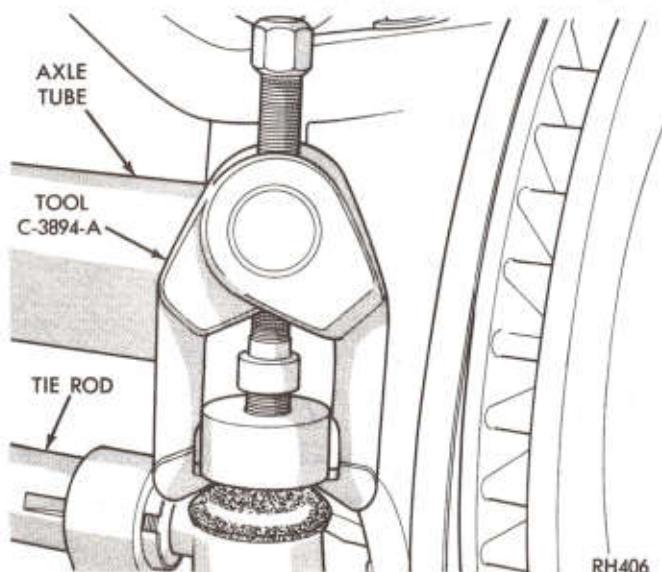


Fig. 25—Removing Tie Rod with Tool C-3894-A

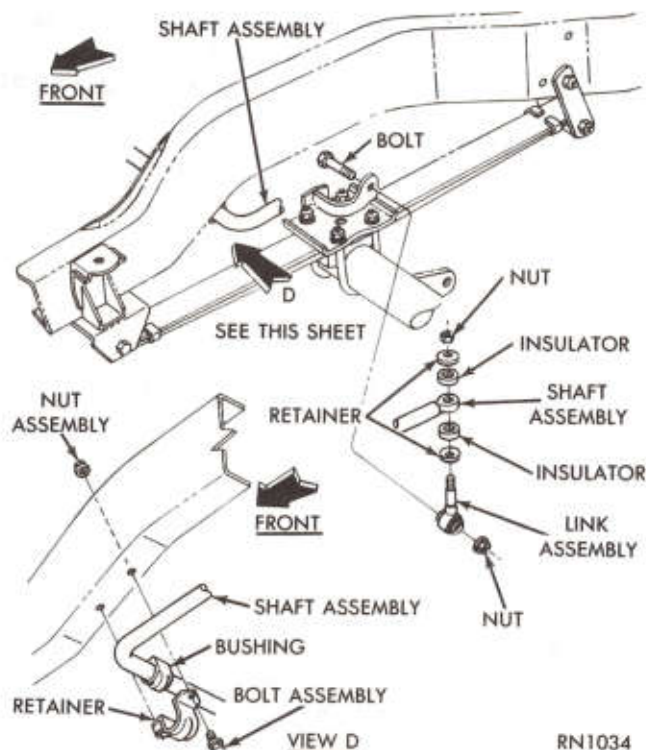


Fig. 26—Front Suspension Sway Bar

(3) Adjust toe, see specifications. Position clamping bolt to bottom of tie rod. Tighten clamping bolt nut to 25-30 ft. lbs. (34-41 N·m). Test vehicle operation.

SWAY BAR (Fig. 26)

Removal

(1) Raise vehicle to a comfortable working height and install jack stands.

(2) Remove nut, retainer and insulator from each link assembly.

(3) Remove mounting bolts, nuts and retainer plate from each frame rail. Lower bar assembly from vehicle.

Installation

(1) Position bar assembly to frame rails. Install retainer plate, mounting bolts and nuts on each side. Tighten nuts to 75 ft. lbs. (102 N·m).

(2) Assemble sway bar over end links. Install insulator, retainer and nut on each link. Tighten nuts to 100 in. lbs. (11 N·m).

(3) Remove jack stands and lower vehicle.

AXLE ASSEMBLY

Removal

(1) Block brake pedal in the up position. Raise vehicle to a comfortable working height and install jack stands.

(2) Disconnect front propeller shaft at drive pinion yoke.

(3) Disconnect drag link at steering knuckle arm (left side only).

(4) Disconnect flexible hydraulic brake line at frame crossmember. Plug lines at fittings.

(5) Disconnect shock absorbers at lower mounts. Disconnect sway bar link assembly from spring clip plate.

(6) Disconnect vacuum lines and wire from switch on disconnect housing assembly.

(7) Remove nuts and washers from U-bolt spring clips. Remove axle assembly from vehicle.

Installation

(1) Position axle under vehicle. Locate spring clip plates over springs with sway bar mounting bracket holes facing toward the rear. Install spring clip U bolts, washers and nuts. Tighten to 110 ft. lbs. (149 N·m).

(2) Connect shock absorbers at lower mounts. Install nuts and tighten to 55 ft. lbs. (75 N·m). Connect sway bar link assembly at spring clip plate. Install nuts and tighten to 200 ft. lbs. (271 N·m).

(3) Remove plugs and connect hydraulic brake line. Tighten to 80-150 in. lbs. (9-17 N·m).

(4) Connect drag link to steering knuckle arm. Install castellated nut and tighten to 60 ft. lbs. (81 N·m). Align cotter key hole in stud with slot in castellated nut, if slot and hole are not aligned continue to tighten nut until aligned. **Do not loosen to align.** Install cotter key.

(5) Connect prop shaft at drive pinion yoke. Install washers and nuts and tighten to 300 in. lbs. (34 N·m).

(6) Connect vacuum lines and wire to disconnect housing assembly.

(7) Remove jack stands, lower vehicle, remove block from brake pedal.

(8) Raise vehicle, bleed brakes, lubricate at all fittings, check axle lubricant level. See "Lubrication and Maintenance" Group 0 of this manual for proper level and type of lubricant required.

(9) Lower vehicle and test operation.

DIFFERENTIAL CASE AND DRIVE PINION

Removal and Disassembly

(1) Thoroughly clean the outer area of carrier and tubes with a suitable cleaning solvent and blow dry with compressed air.

(2) Loosen and remove cover screws and remove carrier cover, drain lubricant into a container.

A close examination of the axle assembly prior to disassembly can often reveal valuable information as to the extent and type of repairs or adjustments necessary. Since the most frequent causes of axle noise are improper backlash or differential bearing preload, or both, a few simple adjustments may be all that is necessary to correct the deficiency.

Therefore, before disassembly the following checks should be made; drive gear and pinion backlash,

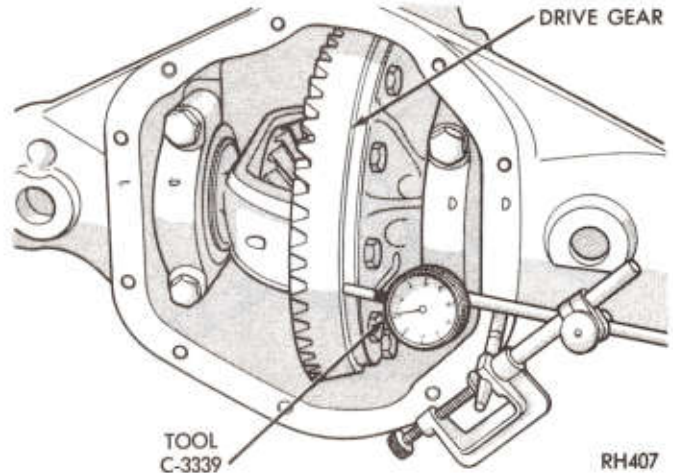


Fig. 1—Checking Drive Gear Runout

pinion bearing preload, and tooth contact pattern and these results recorded and analyzed. It is felt that these measurements will aid you in making the necessary repairs to the axle assembly. See appropriate area of this group for proper procedures.

If, after these tests and adjustments, the deficiency was not corrected, proceed as follows.

(1) Thoroughly clean differential gears, bearings and other internal parts with a suitable solvent.

(2) Install dial indicator Tool C-3339 (Fig. 1) and check the back face of the drive gear for runout. A reading in excess of .006 inch (.152mm) might indicate loose drive gear or a sprung differential case.

(3) Check clearance between differential bearing cap and bearing cup by prying against drive gear. A .003 inch (.076mm) feeler should not enter between bearing cap and cup. A clearance of more than .003 inch (.076mm) could be caused by the bearing cup having turned in the carrier, causing excessive wear.

(4) Remove nut from drive pinion shaft, holding companion flange with Tool C-3281 (Fig. 2).

(5) Remove companion flange with Tool C-452 (Fig. 3).

(6) Remove drive pinion oil seal assembly.

(7) Remove differential bearing caps. Note matching marks on carrier and bearing caps. (Fig. 4).

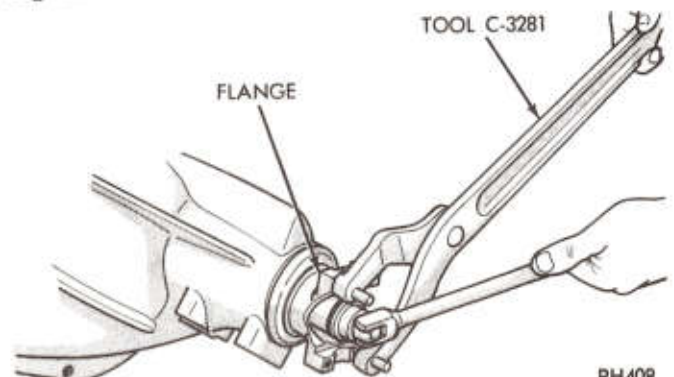


Fig. 2—Servicing Companion Flange Nut (Typical)

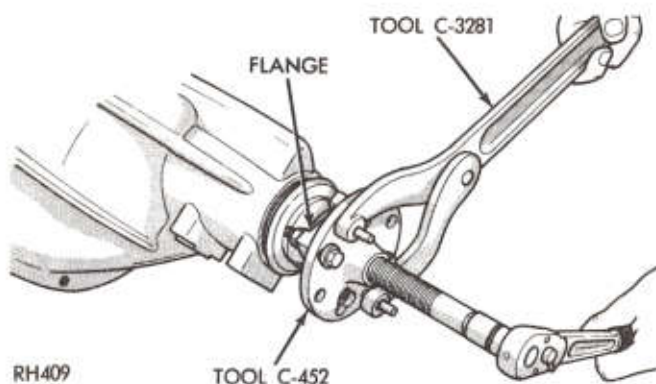


Fig. 3—Removing Companion Flange (Typical)

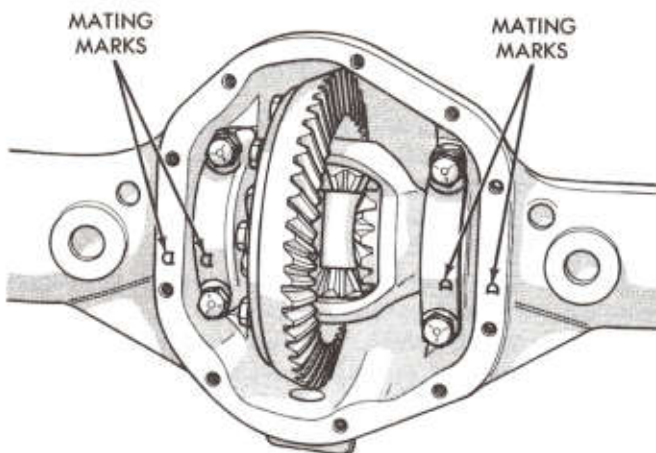


Fig. 4—Marks on Bearing Caps and Carrier

(8) Install carrier spreader, Tool W-129-A with dowels completely engaged to full depth in holes provided in housing (Fig. 5). **Be sure two hold down clamps are properly and firmly holding spreader in position.**

(9) Install a long stud in carrier cover bolt hole on left side of housing. Install dial indicator and fixture,

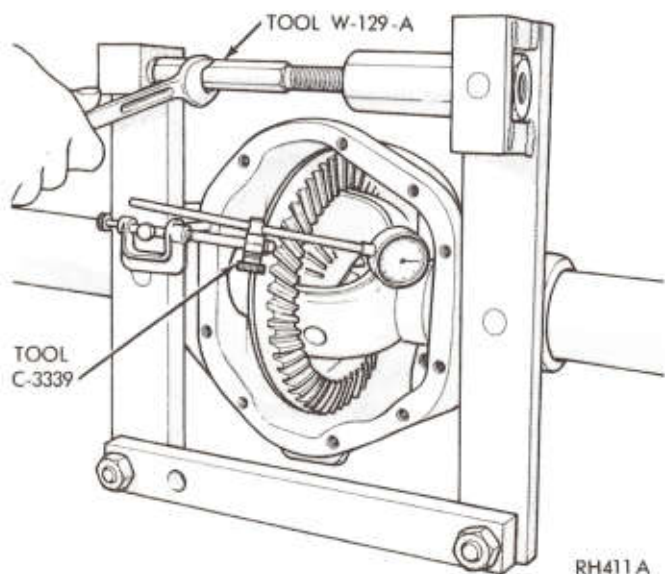


Fig. 5—Differential Carrier Spreader and Indicator

position indicator pointer on opposite side of housing (Fig. 5).

(10) Spread carrier until .015 to .020 inch (.381 to .508mm) spread is shown on indicator. **Do not exceed this limit as it will result in permanent distortion of housing.**

(11) Remove dial indicator fixture.

(12) Pry differential case assembly loose with large screwdriver or bar and lift from carrier. **Pry out differential case assembly as straight up as possible using leverage against differential case and carrier to prevent damage.** Place differential case assembly in holding fixture or use soft jaws if secured in vise.

(13) Remove gear carrier spreader.

(14) Knock out inner oil seal from right axle tube with an old axle shaft or rod.

(15) Remove cups from differential case bearings. **If bearing cones and cups are not worn or damaged and are to be reassembled, make certain each mating cup and cone are paired together with the bearing cap.**

(16) Remove drive gear mounting bolts and remove gear. Discard bolts.

(17) Drive out lock pin securing differential pinion shaft to case (Fig. 6).

(18) Remove differential pinion mate shaft, differential pinion mates and thrust washer (one back of each pinion). Remove differential side gears and thrust washers (one back of each gear). **If it was previously found that excessive drive gear runout existed, the cause should be determined at this time.**

(19) If drive gear was found to be seated tightly against differential case flange at all points with no uneven surfaces or other causes preventing good alignment, check runout of drive gear mounting flange surface.

(20) Install differential assembly (with drive gear removed) in carrier housing. Attach dial indicator as previously described and check runout of drive gear mounting face of differential case flange.

(21) If total indicator reading taken while rotating differential case indicates excessive runout, the condi-

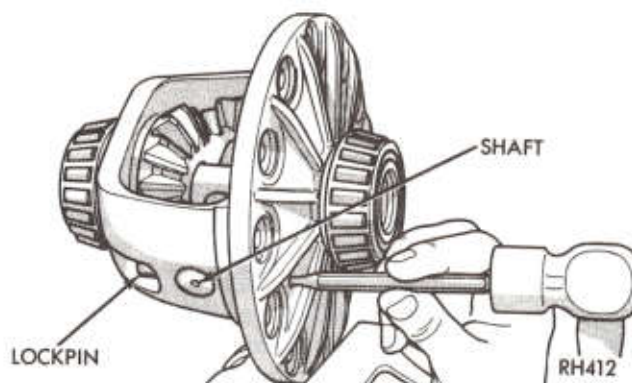


Fig. 6—Removing Differential Pinion Shaft Lockpin (Typical)

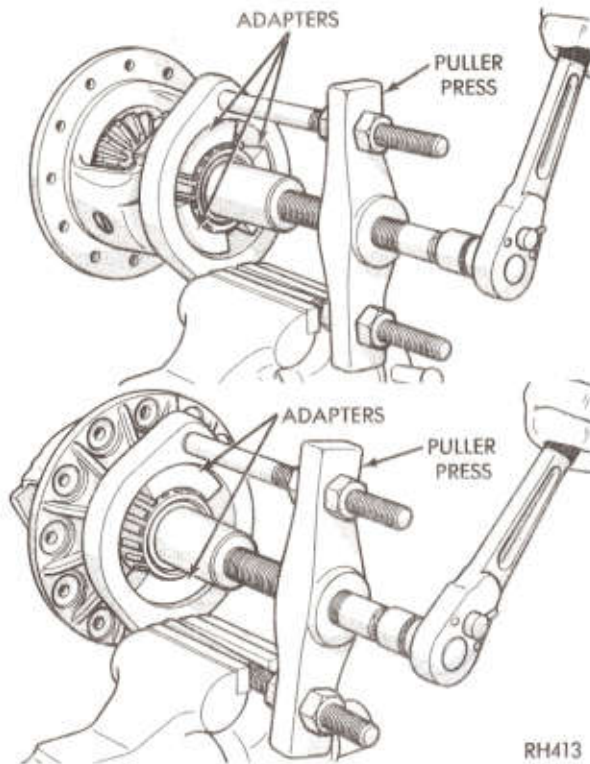


Fig. 7—Removing Differential Bearings

tion can be corrected by replacing the differential case. If machine shop facilities are available, the condition can be corrected by removing a light cut from drive gear mounting surface on case flange.

(22) Using Tool C-293-PA press with C-293-18 plates and C-293-3 plug, remove differential bearing cones (Fig. 7). Care must be taken to insure that bearing remover is located so as not to pull on bearing cage.

(23) Remove bearing shims. **If drive gear and drive pinion are to be reassembled, note position of shims so they may be installed accordingly. Replace damaged shims with new of the same thickness.**

(24) Press out drive pinion shaft and inner bearing cone assembly. Lift bearing preload shim pack off shaft assembly and record shim thickness.

(25) Lift out oil seal gasket, slinger and outer bearing cone.

(26) Remove outer and inner bearing cups from carrier using a drift. Remove shims from in back of inner cup and record thickness of the shims.

(27) Using Tool C-293-PA press with C-293-39 plates, remove inner pinion bearing cone (Fig. 8). Care must be taken to insure that bearing remover is located so as not to pull on bearing cage.

(28) Wash all parts including carrier and tube assembly with suitable solvent. Do not steam clean. (Fig. 9) shows an exploded view of the differential assembly.

(29) Examine all bearing surfaces and splines for burrs or scoring. Remove burrs with a hand stone.

(30) Check all bearing cups and cones for nicks,

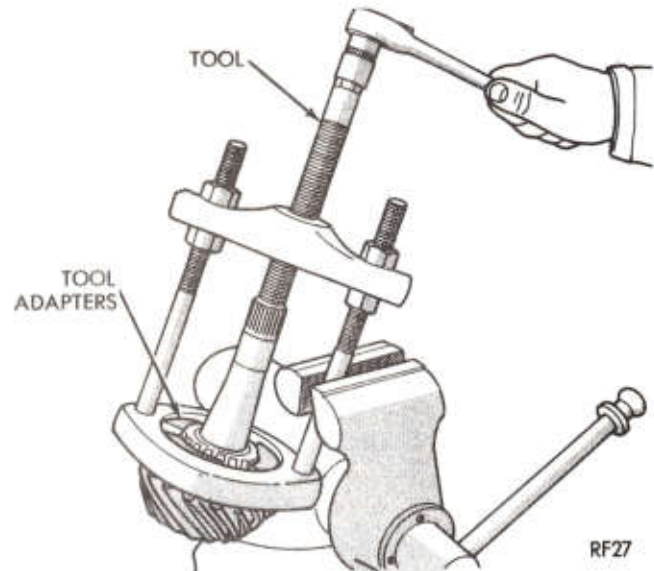


Fig. 8—Removing Bearing Cone from Pinion

roller end wear, grooves or any damage, and replace accordingly. Replace all bearings if axle has high mileage.

(31) Examine differential pinion mate shaft, pinion mates, side gears and thrust washers for wear or damage, replace all defective parts. **Pinion mates should be replaced in sets. Do not replace one mate only.**

(32) All seals once removed should be replaced with new parts.

(33) Drive gears and drive pinions are available in matched sets. **Do not replace one gear or one pinion only.**

Assembly and Installation

(1) Lubricate all parts with differential lubricant. Install differential side gears and thrust washers, pinion mates and thrust washers and pinion mate shaft in differential case. Align hole in shaft with hole in case. Drive in lock pin. **If new gears and washers are used, it will not be necessary to check gear backlash. Correct fit is provided due to close manufacturing tolerances.**

(2) Place differential case assembly in holding fixture. Install drive gear with new bolts. Tighten bolts to 45-60 ft. lbs. (61 to 81 N-m).

(3) Install master differential bearings Tool D-135 onto case (Fig. 10).

(4) Install spreader and dial indicator on carrier and spread case .015 to .020 inch (.381 to .508mm) (Fig. 28). Then remove dial indicator fixture.

(5) Insert differential case in carrier. Install bearing caps in their correct positions and tighten bearing cap bolts finger tight.

(6) Remove spreader and install dial indicator fixture with indicator pointer contacting back of drive gear.

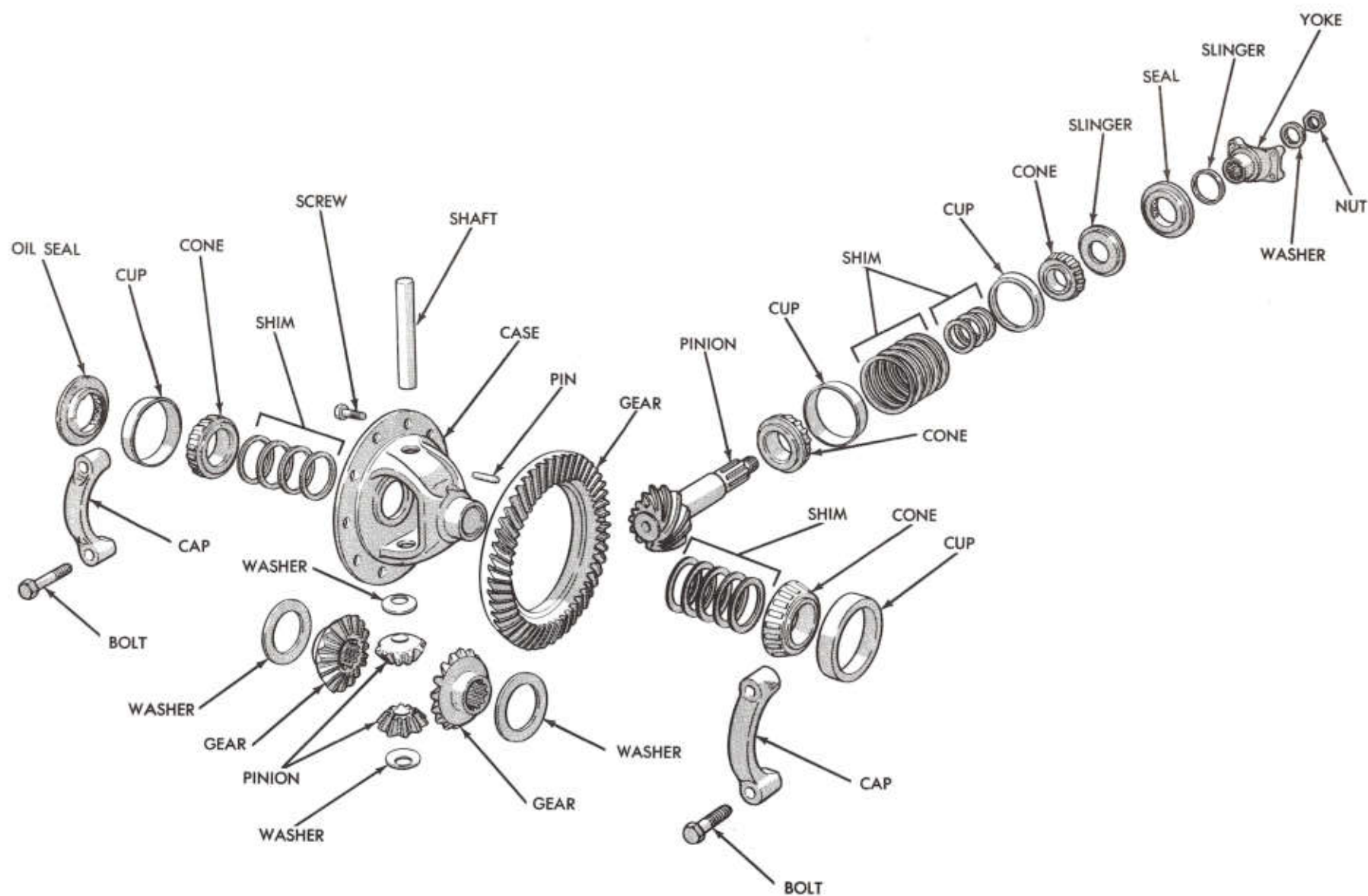


Fig. 9—Differential, Front Driving (44-8FD) Axle

RH414 A

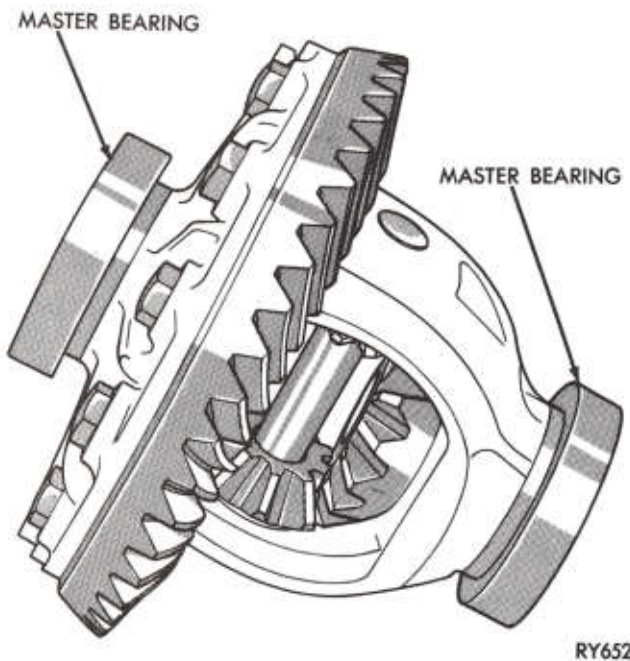


Fig. 10—Master Bearing Installed

(7) Place a screwdriver blade between bearing cup and housing and pry case assembly as far as possible to one side of housing. Set dial indicator at zero. Pry case to opposite side of housing and record the reading (Fig. 11).

This reading indicates the amount of shims needed behind side bearings to take up clearance between differential bearing cups and case. The shim pack thickness to be placed between bearing cone and differential case will be calculated later in

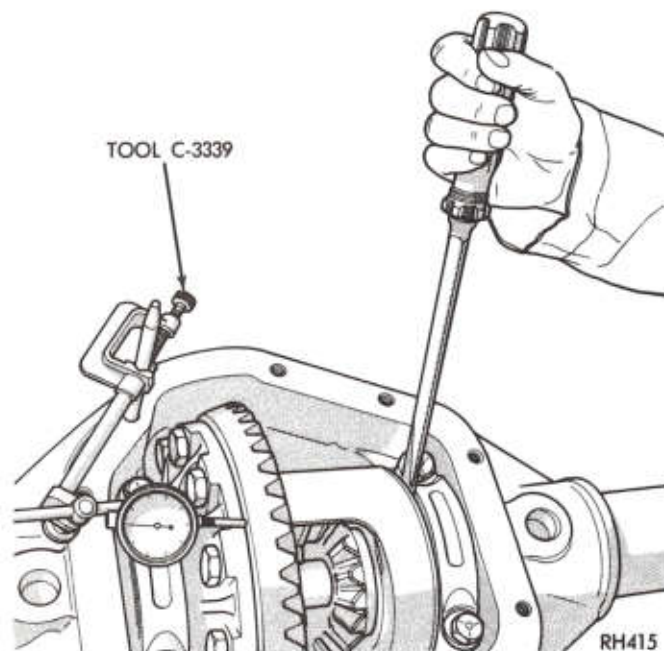


Fig. 11—Determining Shims to Obtain "0" End Clearance

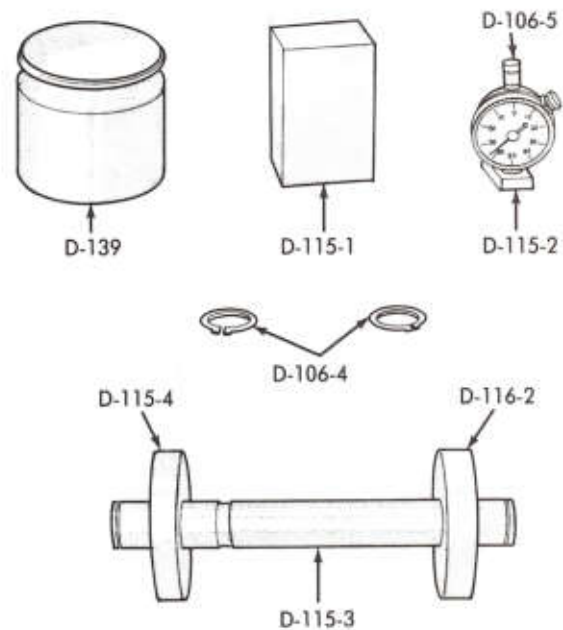


Fig. 12—Pinion Depth Gauge Tools from D-271

the procedure after installation of drive pinion.

(8) Install spreader and dial indicator and spread carrier .015 to .020 inch (.381 to .508mm). Remove bearing caps and lift differential assembly from the housing. Then remove spreader.

(9) Install right axle shaft inner oil seal with Tool DD-1243-B.

DRIVE PINION DEPTH OF MESH SETTING AND PINION BEARING PRELOAD

**(Using Pinion Depth Gauge Tool Set D-271)
(Fig. 12)**

Ring gears and pinions are supplied in matched sets only. Matching numbers on both the pinion and ring gear are etched for verification.

On the face of each pinion there is etched either a plus (+) number, or a minus (−) number, or "0" which indicates the best running position for each particular gear set. This dimension is controlled by shimming behind the inner pinion bearing cup. (Fig. 13).

The distance from the centerline of the ring gear to the face of the pinion is 2.625" (66.68mm) (Fig. 14).

If the etched figure is "0" the shim pack will remain unchanged.

For example—if a pinion is etched +3 (m + 8) this pinion would require .003" (.08mm) less shims than a pinion etched "0". By removing shims, the mounting distance of the pinion is increased to 2.625" (66.76mm), which is what a +3 (m + 8) indicates. Or if a pinion is etched −3 (m − 8), we must add .003" (.08mm) more shims than would be required if the

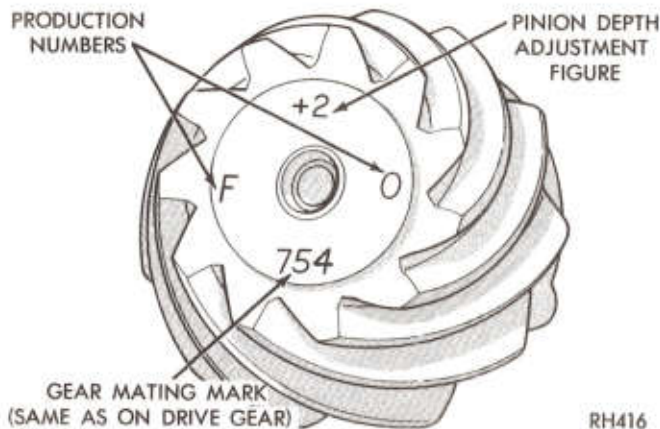


Fig. 13—Drive Pinion Markings

pinion were etched "0". By adding .003" (.08mm) shims, the mounting distance of the pinion is decreased to 2.622" (79.12mm) which is what a -3 (m - 8) indicates.

If a new gear set is being used, notice the (+) or (-) etching on both the old and new pinion and adjust the thickness of the new shim pack to compensate for the difference of these two figures.

For example—if the old pinion reads (+) 2 (m + 5) and the new pinion is (-) 2 (m - 5), add .004" (.10mm) shims to the original shim pack.

If the old ring and pinion set is to be reused, measure the old shim pack and build a new shim pack to this same dimension. If a baffle is used in the axle assembly, its thickness is considered as part of the shim pack. Shims are available in thicknesses of .003", .005", .010", and .030" (.08, .13, .25, and .76mm). **Gauges in Figure 12 vary in accordance with the axle being checked.**

(1) Place master pinion block Tool D-139 into the pinion bore of the carrier (Fig. 15).

(2) Mount arbor discs Tool D-115-4 on arbor Tool D-115-3 and install into cross bores of carrier (Fig. 16).

(3) Place pinion height block Tool D-115-1 on the top of master pinion block and against arbor (Fig. 17).

(4) Position gauge assembly, Tool D-115-2 gauge

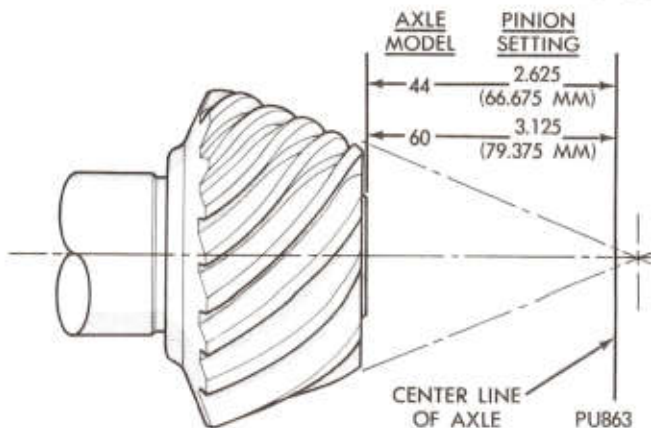
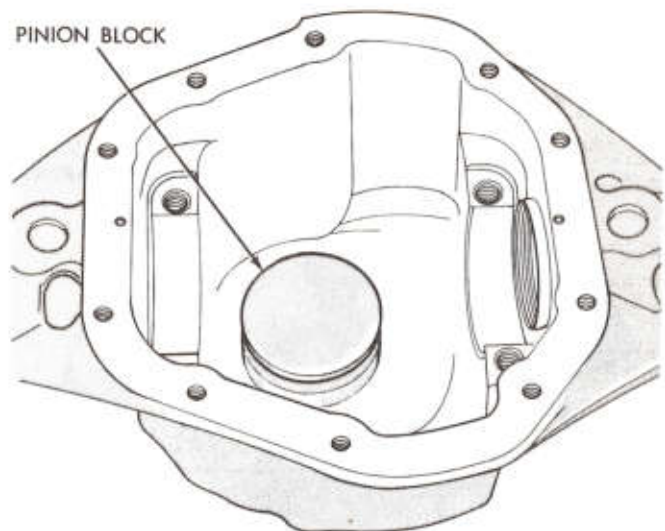


Fig. 14—Pinion Setting Dimension



RY654 A

Fig. 15—Master Pinion Block Installed in Pinion Bore

block and D-106-5 dial indicator, on small step of pinion height block. Making sure that the gauge assembly is flat on the pinion height block, set the dial indicator to read "0" (Fig. 18).

(5) With indicator set at "0", move the gauge assembly so that the tip of the dial indicator stem contacts the arbor. Move the gauge assembly back and forth to obtain the indicator reading at the highest point of contact.

This reading, plus or minus the value of the etched figure on the face of the pinion is the required thickness of the pinion bearing shim pack.

(6) Measure each shim separately with a micrometer and add together to get total shim pack thickness. If baffle is required, its thickness is to be included in the shim pack. If baffle is used between the inner bearing cone and thrust face of pinion, the baffle thickness is

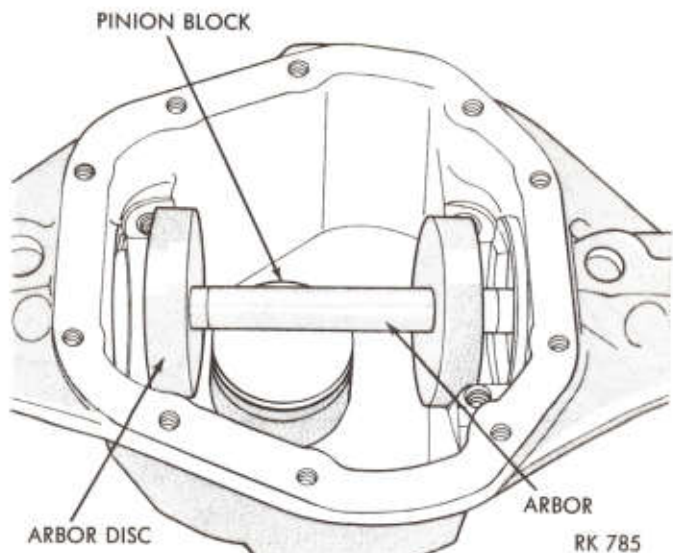


Fig. 16—Arbor Discs and Arbor in Position

PINION SETTING CHARTS (U.S. AND METRIC)

By utilizing these specifications, proper gear contact should be established.

Old Pinion Marking	New Pinion Marking (U.S. Standards)								
	-4	-3	-2	-1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003
0	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004
-1	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005
-2	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006
-3	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007
-4	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007	-0.008

Old Pinion Marking	New Pinion Marking (Metric)								
	-10	-8	-5	-3	0	+3	+5	+8	+10
+10	+.20	+.18	+.15	+.13	+.10	+.08	+.05	+.03	0
+8	+.18	+.15	+.13	+.10	+.08	+.05	+.03	0	-.03
+5	+.15	+.13	+.10	+.08	+.05	+.03	0	-.03	-.05
+3	+.13	+.10	+.08	+.05	+.03	0	-.03	-.05	-.08
0	+.10	+.08	+.05	+.03	0	-.03	-.05	-.08	-.10
-3	+.08	+.05	+.03	0	-.03	-.05	-.08	-.10	-.13
-5	+.05	+.03	0	-.03	-.05	-.08	-.10	-.13	-.15
-8	+.03	0	-.03	-.05	-.08	-.10	-.13	-.15	-.18
-10	0	-.03	-.05	-.08	-.10	-.13	-.15	-.18	-.20

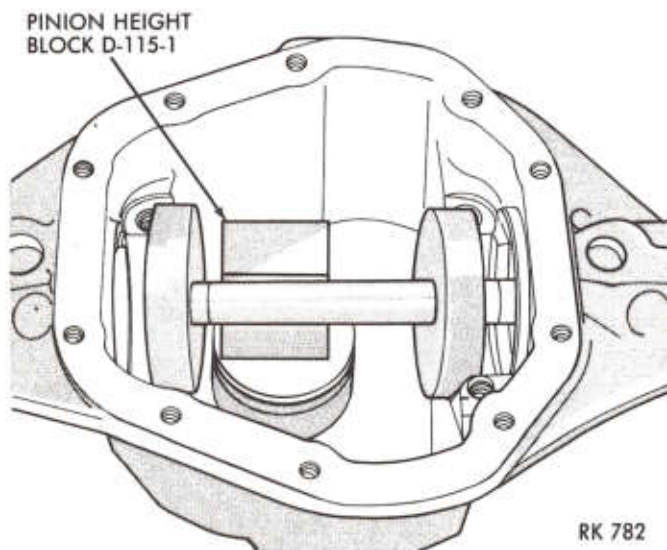


Fig. 17—Pinion Height Block Positioned Against Arbor

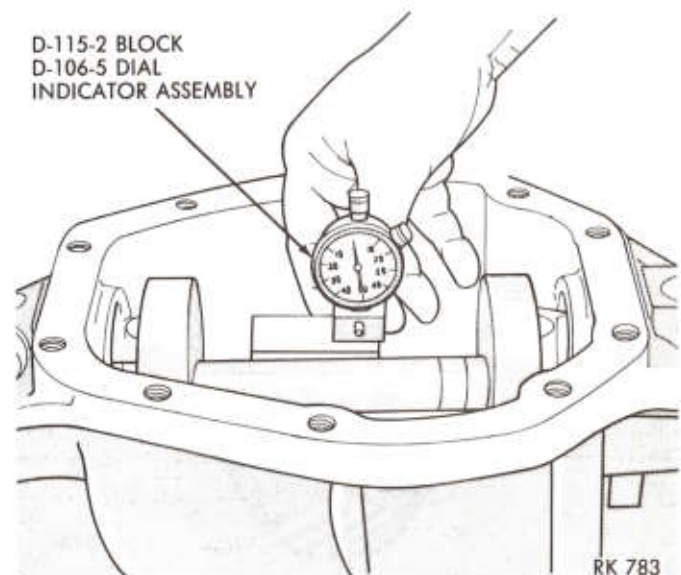


Fig. 18—Checking Pinion Depth

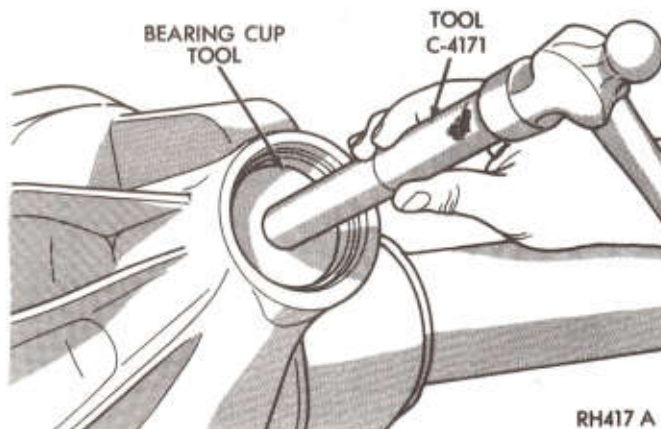


Fig. 19—Installing Outer Pinion Bearing Cup

also to be measured and included as part of the total shim pack.

Place the required amount of shims (and baffle if used) in the inner bearing bore; drive the inner bearing cup into the carrier using Tool D-111 cup installer and C-4171 Handle. Make sure cup is seated.

Pinion Bearing Preload

(1) Using Tool D-144 and Tool C-4171 drive the outer pinion bearing cup into the carrier (Fig. 19).

(2) Drive or press inner bearing onto shaft until it is completely seated using Tool W-262 (Fig. 20).

(3) Install pinion into carrier followed by the outer pinion bearing cone, (baffle if used), end yoke, washer and nut. Use yoke installing Tool C-496 and Tool C-3281 (Fig. 21).

Do not assemble preload shims or pinion oil seal at this time.

(4) Using inch-pound torque wrench, rotate pinion.

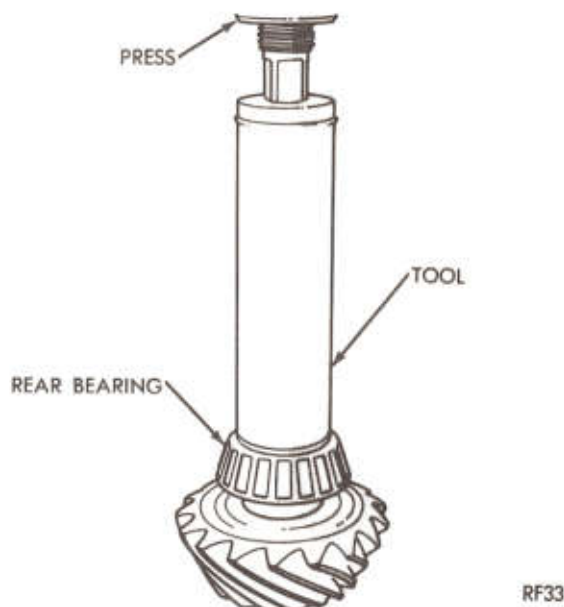


Fig. 20—Installing Pinion Bearing Cone

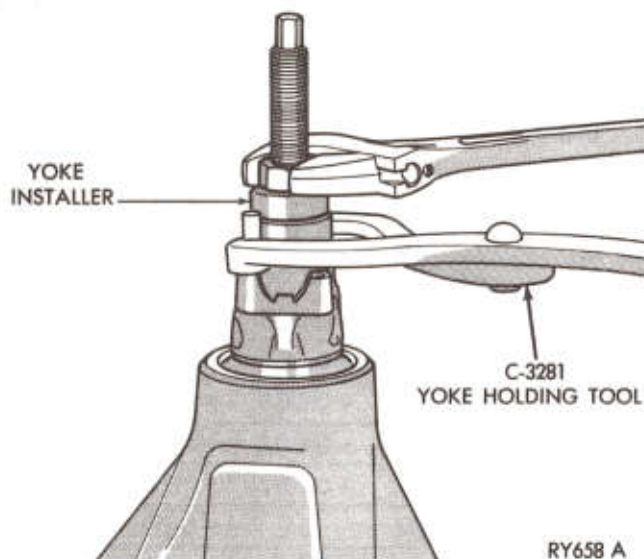


Fig. 21—Installing Pinion and Yoke

Tighten yoke nut until it requires 10 in. lbs. (1 N·m) to rotate pinion (Fig. 22).

(5) Recheck pinion depth at this time by placing arbor and discs into cross bore of the carrier. Place pinion height block on face of pinion. Set dial indicator on height block. Set dial indicator at "0". Slide gauge assembly across or over arbor. See Fig. 18.

Indicator will read a plus (+) or minus (−) at its highest point, depending on the etched figure on the pinion.

Indicator reading within .002 inch (.05mm) of etching is considered acceptable. If pinion position is found to be within specifications continue with build up. If pinion position is not within specifications change shim pack thickness under inner bearing cup.

(6) Remove pinion nut, washer, end yoke, slinger, and bearing cone. Assemble preload shims (which were removed during disassembly) onto pinion. Assemble bearing cone, and slinger.

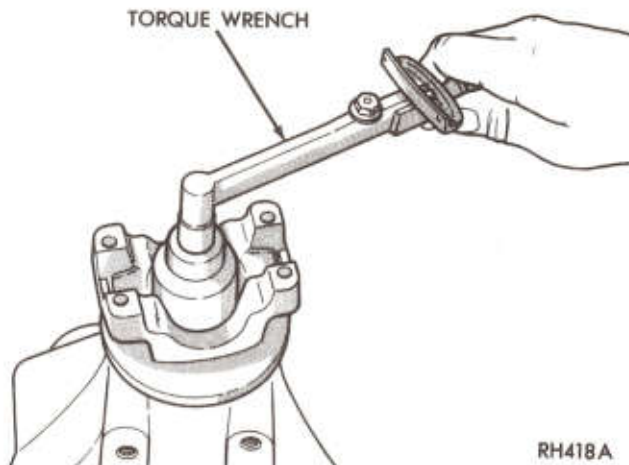


Fig. 22—Rotating Pinion to Seat Bearings

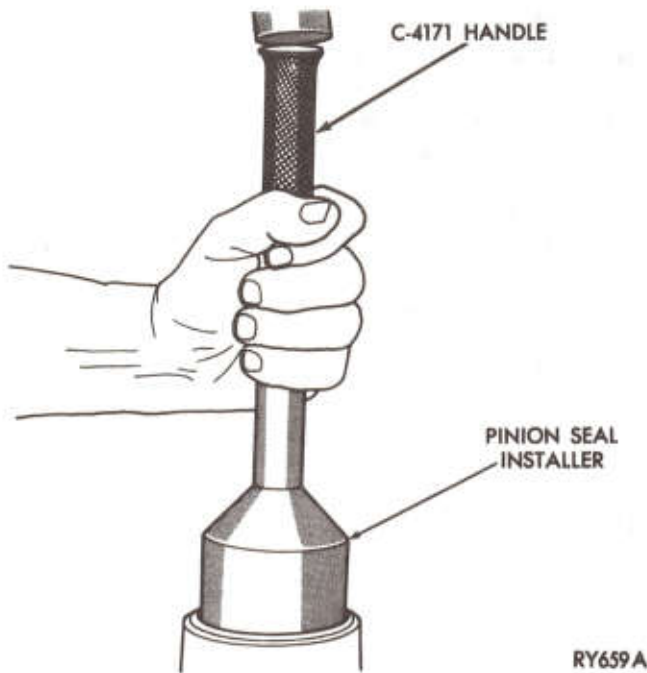


Fig. 23—Installing Pinion Seal

Apply a light coat of hypoid lubricant on the lip of pinion seal and assemble into carrier using seal installing Tool W-147 and C-4171 Handle (Fig. 23).

(7) Assemble end yoke, washer, and new pinion nut. Tighten to 240-300 ft. lbs. (325-406 N·m).

(8) Using an inch-pound torque wrench as shown rotate pinion. Torque required to rotate pinion should read between 20-40 in. lbs. (2-5 N·m). To increase

preload, remove shims; to decrease preload add shims.

The illustration in Figure 24 shows the arrow in the pinion pointing in two directions. The direction pointing towards the end yoke indicates that by removing pinion position shims, the distance from the centerline of the axle to pinion face is increased giving a plus reading. The preload shim pack does not affect the pinion depth setting. Arrows on the ring gear illustrate the method to increase or decrease backlash and differential bearing preload.

(9) With master bearing Tool D-135 installed on the differential case, place assembly into housing.

(10) Set up dial indicator as shown in (Fig. 11). Press ring gear into mesh with the pinion. Rock ring to allow the teeth of the gears to mesh. With pressure still applied to the differential case, set indicator at "0".

(11) Press the differential case (ring gear) away from the pinion gear to obtain an indicator reading. Repeat until the same reading is obtained each time. This reading will represent the necessary amount of shims required between the differential case and differential bearing on the ring gear side. Remove indicator and differential case from the carrier. Remove differential from case, remove master bearings.

(12) Assemble the required amount of shims onto hub (ring gear side) as determined. Place bearing cone on hub of case. Use bearing installer Tool C-4028-A and C-4171 handle, seat bearing cone (Fig. 25).

(13) Assemble the remaining of the total shim pack which was determined in step 7, assembly and installation, on the opposite side of the differential case. Add an additional .015 inch (.38mm) of shims on this side to compensate for differential bearing preload. Assemble differential bearing using Tool C-4025 and C-4171.

(14) Install spreader and indicator to carrier and spread housing.

Do not spread over .020 inch (.51mm). Remove indicator.

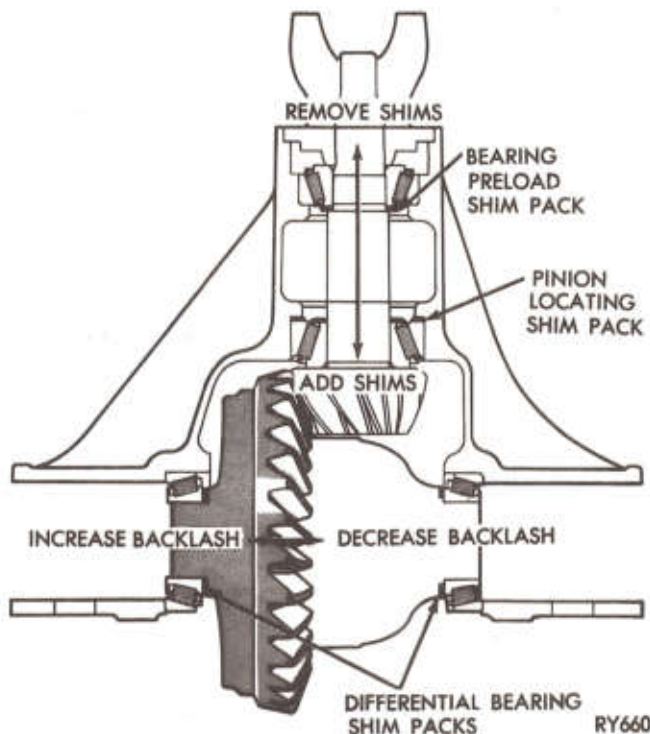


Fig. 24—Use of Shims to Adjust Gear Tooth Contact



Fig. 25—Seating Bearing Cone

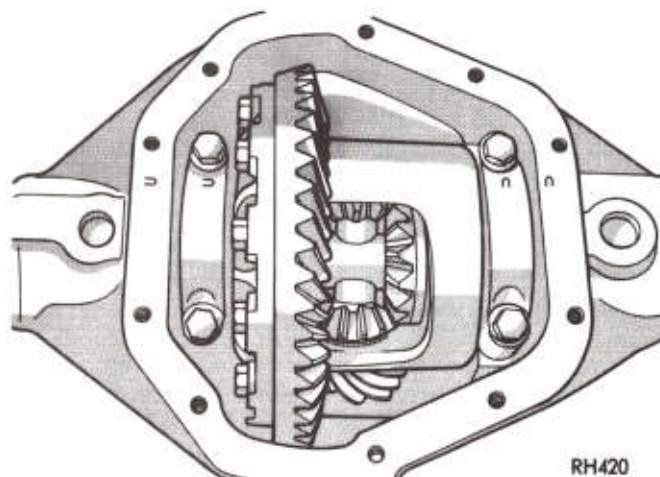


Fig. 26—Differential Installed in Carrier

(15) Assemble differential bearing cups to differential bearing cones. Install differential assembly into carrier.

(16) Install bearing caps. Make sure the letters stamped on the caps correspond with those on the carriers. Tighten bearing cap screws to 80-90 ft. lbs. (108-122 N-m). (Fig. 26).

(17) Check ring gear and pinion backlash in three equally spaced points with dial indicator as shown in (Fig. 27).

Backlash tolerance is .004 to .009 inch (10-23 mm) and cannot vary more than .002 inch (.05mm) between points checked.

High backlash is corrected by moving the ring gear closer to the pinion.

Low backlash is corrected by moving ring gear away from pinion.

These corrections are made by switching shims from one side of the differential case to the other. (Fig. 24).

(18) Install new cover gasket and install cover plate. Tighten screws to 30-40 ft. lbs. (41-54 N-m).

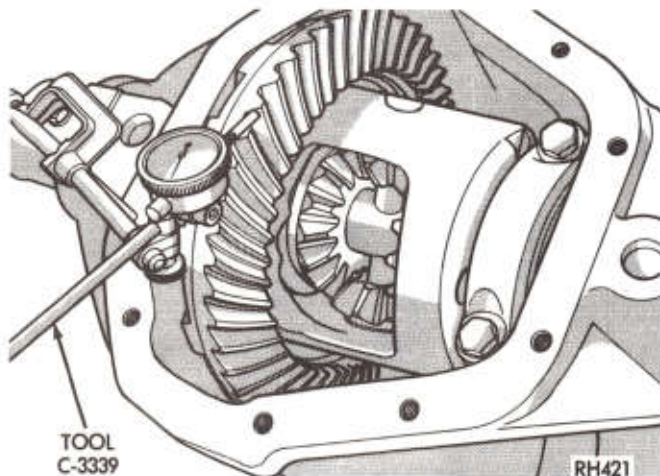


Fig. 27—Checking Ring and Pinion Gear Backlash

DRIVE PINION DEPTH OF MESH SETTING AND PINION BEARING PRELOAD

(Using Tool C-3715-B)

Front axle setting gauge Tool C-3715-B is used to install drive pinion bearing cups as well as to determine pinion depth of mesh.

(1) Start both drive pinion bearing cups into axle housing.

(2) Assemble pinion locating spacer Tool SP-5586 over main body of Tool SP-5385 followed by rear bearing cone. Position tool in axle housing, then install shaft locating sleeve SP-5585, front bearing cone, compression sleeve SP-3194-B, centralizing washer SP-534 and compression nut SP-3193.

(3) Lubricate drive pinion bearing cones with MOPAR Hypoid Lubricant P/N 4318058 or equivalent.

(4) To install pinion bearing cups, hold compression sleeve from turning with Tool C-3281, tighten nut, thereby drawing pinion bearing cups into axle housing bearing cup bores (Fig. 28).

(5) Permit tool to turn several revolutions during tightening operation to permit bearing rollers to align and prevent brinnelling of bearing cups. **Do not remove tool after installing cups. Pinion depth of mesh will be determined next.**

(6) With main tool left in axle housing after installing drive pinion bearing cups, loosen tool nut and retighten nut to produce 10-30 in. lbs. of preload. Rotate while tightening to align bearing rollers.

(7) Install gauge block SP-3250 on end of main body SP-5385, install cap screw SP-536 and tighten securely with SP-531 wrench.

(8) Position cross bore arbor SP-5183 in axle housing in differential bearing seats. Center the arbor so that an approximate equal distance is maintained at both ends. Correctly position differential bearing caps and insert bolts and tighten to 10 ft. lbs. (1 N-m).

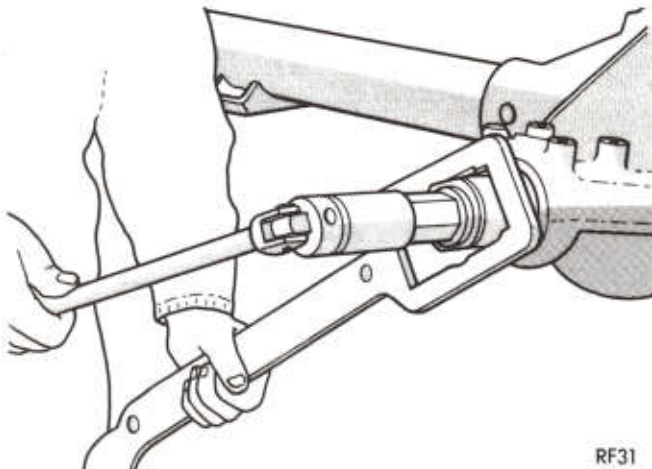


Fig. 28—Seating Bearing Cups in Axle Housing

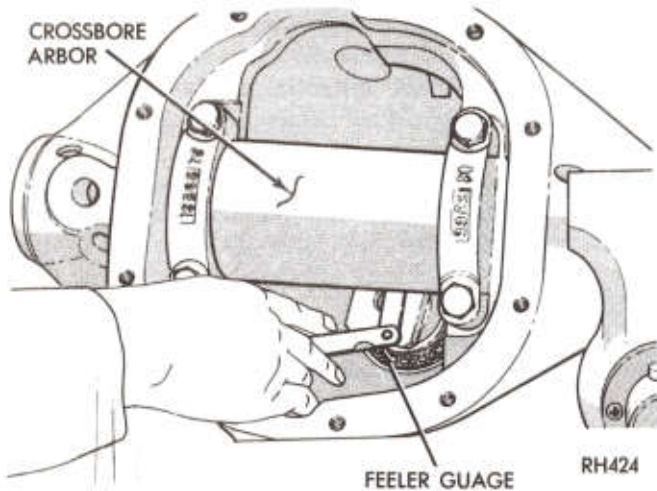


Fig. 29—Determining Shim Pack Thickness for Drive Pinion Depth of Mesh

(9) Using a feeler gauge select the proper thickness of shims that will snugly fit between arbor and gauge block. This fit must be snug but not too tight (similar to the pull of a feeler gauge). This measurement is then used in determining the correct thickness shim pack for installation behind the rear pinion bearing cup and carrier casting (Fig. 29).

(10) To select a shim pack for installation, read the markings on the end of pinion head (-0, -1, -2, +1, 2, etc.). When marking is -, add that amount to the thickness of shim pack selected in step (9). When the marking is + subtract that amount. Treat other pinion markings in a similar manner. Shims are available in .003, .005, and .010 inch (.076, .127, and .254mm) thickness. See "Pinion Setting Chart".

(11) Remove tool arbor and tool from housing.

(12) Using a brass drift or soft punch and hammer, remove rear pinion bearing cup from casting.

(13) Position the correct shim pack in axle housing cup bore and install rear bearing cup as described previously in steps (1) thru (5). When cup is properly seated, remove tool and pinion bearing cones.

(14) Lubricate rear drive pinion bearing cone with MOPAR Hypoid Lubricant Part Number 4318058 or equivalent and install bearing cone on pinion stem using Tool W-262. An arbor press may be used in conjunction with tool.

(15) Install drive pinion and bearing assembly in carrier and install the original front pinion bearing shim pack followed by the bearing cone. **Do not install oil seal at this time.**

(16) Install universal joint flange, washer, and nut. Tighten nut 200 to 220 ft. lbs. (271 to 298 N·m). Rotate pinion several complete revolutions to seat bearing rollers.

(17) Using an inch-pound torque wrench C-685-A, measure pinion bearing preload by rotating pinion with handle of wrench floating (Fig. 30). Take reading while handle is moving through several complete revolutions.

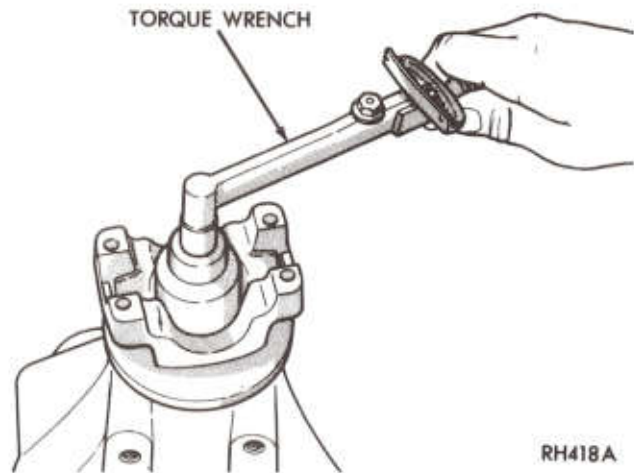


Fig. 30—Checking Pinion Bearing Preload

Correct preload is 20-40 in. lbs. (2 to 5 N·m) with new bearings or 10-20 in. lbs. (1 to 2 N·m) if the old bearings were used. **Add** shim to decrease preload and **Subtract** shims to increase preload. Shims are available in the following thicknesses: .003, .005, .010, and .030 inch (.076, .127, .254, and .762mm).

(18) After the correct pinion bearing preload has been established, remove the universal joint flange, nut and washer.

(19) Install oil slinger and gasket. Install a new oil seal. If dust shield has been removed, install new dust shield.

(20) Install universal joint flange, washer, and nut. Using Tool C-3281 to hold flange, tighten pinion nut 200 to 220 ft. lbs. (271 to 298 N·m). Recheck pinion bearing preload.

(21) Install axle shaft inner oil seals with Tool DD-1243-B.

DIFFERENTIAL BEARING PRELOAD AND DRIVE GEAR AND PINION BACKLASH

(1) With drive pinion and bearings installed and bearing preload set, install differential case and ring gear assembly with their respective bearing cups. Install bearing caps in their positions, align identification marks and tighten cap bolts finger tight.

Refer to the measurement taken previously in step (7) of "Differential Case and Drive Pinion", "Assembly and Installation".

This reading taken before the drive pinion was installed represents the total clearance between the differential bearing cups and the carrier casting. Perform the following steps to determine the thicknesses of shims required behind each bearing cone to take up the clearance and establish the correct bearing preload and backlash.

(2) Install a dial indicator and position the contact point against back face of ring gear. Move the differential and ring gear assembly tight against the drive

pinion, set the dial indicator on zero. Move the differential and ring gear assembly in the opposite direction as far away from pinion as possible and note the reading on dial indicator.

This reading represents the thickness of shim pack necessary to take up the clearance between the bearing cup and the case on the ring gear side of the differential assembly. Subtract this reading from the previously recorded total reading to obtain the amount of shims necessary to take up the clearance between the bearing cup and the case at the pinion side of the differential.

(3) Remove differential and ring gear assembly.

(4) Remove differential bearing cones. Install the correct thickness shim pack as determined in step (2) between bearing cone and differential case hub shoulder using Tool C-4028-A. Add an additional .015 inch (.381mm) shims to the drive gear tooth side of differential and install the differential bearing cones. This additional .015 inch (.381mm) shim pack provides the correct bearing preload and backlash.

(5) Position spreader Tool W-129 in locating holes of carrier and tighten screw finger tight. Install dial indicator and spread carrier .015 to .020 inch (.381 to .508mm). Do not exceed this limit to permit placing of differential and ring gear assembly in carrier.

(6) Install the bearing caps in their respective positions as indicated by identification marks on caps and carrier. Remove the spreader tool. Coat the bearing cap bolt threads with sealing compound and install and tighten bolts snugly.

(7) Tap the drive gear lightly with a rawhide hammer to properly seat the differential bearing and cups. **Care must be taken in this operation to prevent nicking the teeth of ring gear or drive pinion as they are meshed together.** Tighten the bearing cap bolts

to 70 to 90 ft. lbs. (95 to 122 N·m).

(8) Attach a dial indicator to carrier and with indicator contact point contacting ring gear tooth (Fig. 27), measure the backlash between the ring gear and drive pinion.

(9) Check backlash at four equally spaced points around circumference of ring gear. Backlash must be held between .005-.009 inch (.127-.229mm) and cannot vary more than .003 inch (.076mm) between the four positions checked.

If backlash does not fall within these specifications, change shim pack thickness on both differential bearing hubs to maintain proper bearing preload and backlash.

GEAR TOOTH CONTACT PATTERN

Gear tooth contact pattern will be correct if all preceding procedures have been followed.

LUBRICATION

When vehicle is serviced for other reasons, check for evidence of gear oil leakage. If leakage is evident, check the fluid level in the axle through the filler plug hole. When checking the level, be sure the vehicle is in a level position on an axle or drive on type hoist. Maintain fluid level to bottom of filler plug hole.

In these Differentials, use only the MOPAR Hypoid Lubricant Part Number 4318058 or equivalent.

Should the axle become submerged in water, the lubricant must be changed immediately to avoid the possibility of early axle failure resulting from contamination of the lubricant by water.

60 FRONT AXLE

INDEX

	Page		Page
Axle Assembly		Dualmatic Locking Hub	35
Installation	42	Gear Tooth Contact Pattern	53
Removal	42	General Information	35
Axle Shaft and Joint Assembly		Lubrication	54
Assembly	38	Pinion Bearing Preload	52
Disassembly	38	Service Diagnosis	12
Installation	39	Service Procedures	35
Removal	37	Servicing Braking Disc (Rotor) or Bearings	36
Differential Bearing Preload and Drive Gear and Pinion Backlash	53	Specifications	55
Differential Case and Drive Pinion		Steering Knuckle	
Assembly and Installation	46	Assembly and Installation	39
Cleaning and Inspection	46	Removal and Disassembly	39
Removal and Disassembly	43	Steering Knuckle Arm	
Drag Link		Installation	41
Installation	42	Removal	41
Removal	41	Tie Rod End	
Drive Pinion Depth of Mesh (Using Tool C-758-D6)	52	Installation	42
Drive Pinion Depth of Mesh Setting (Using Pinion Depth Gauge Tool D-271)	47	Removal	42
		Tightening Reference	56
		Wheel Bearing Adjusting Procedure	36

GENERAL INFORMATION

This model 60 Front Driving Axle is composed of the outer drive assemblies, the differential carrier and tube assembly (Axle Housing), and the differential case, and drive pinion assembly.

This axle is of the integral carrier-housing, hypoid gear type in which the center line of the drive pinion is mounted below the center line of the ring gear.

The axle housing is an iron casting with tubular legs pressed into and welded to the carrier to form a carrier and tube assembly. A removable stamped steel cover is bolted to the carrier to permit visual inspection of the differential without removing the complete axle from the vehicle.

A small metal tag is attached beneath one of the cover screws to identify the axle ratio. This tag is stamped with the number of teeth on the drive pinion and ring gear and the axle ratio.

The drive pinion is supported by two preloaded taper roller bearings. The rear pinion bearing cone is a tight press-fit on the pinion stem. The front pinion

bearing is a light press-fit to a close sliding fit on the pinion stem. The front and rear bearing cups are a press-fit against a shoulder recessed in the carrier. The drive pinion depth of mesh adjustment is controlled by locating shims, which are installed between the rear pinion bearing cup and the carrier casting.

Drive pinion bearing preload is maintained by using different thicknesses of shim packs between the drive pinion bearing shoulder and front pinion bearing cone.

The differential case is supported by two taper roller bearing cones which are a press-fit on the differential case hubs. Shims installed between the bearing cone and shoulder of hub of differential case, perform three functions: They eliminate the differential case side play; they adjust and maintain the backlash between the ring gear and drive pinion; and establish a means of obtaining differential bearing preload.

SERVICE PROCEDURES

DUALMATIC LOCKING HUB

Removal and Disassembly

- (1) Turn shift knob to "engage" position.
- (2) Apply pressure to the face of shift knob, remove the three screws spaced 120° apart and nearest to the flange.
- (3) With an outward pull, remove shift knob from mounting base.
- (4) Remove snap ring from axle shaft.
- (5) Remove capscrews and lockwashers from mounting base flange.

- (6) Separate and remove locking hub assembly from rotor hub; remove and discard gasket.

Inspection

Wash parts in mineral spirits and blow dry with compressed air. Examine splines shift knob, cam, sliding gear, drive shaft gear, and mounting base for damage.

Assembly

Lubricate parts lightly with MOPAR Multi-Purpose lubricant, Part Number 4318063 or equivalent.

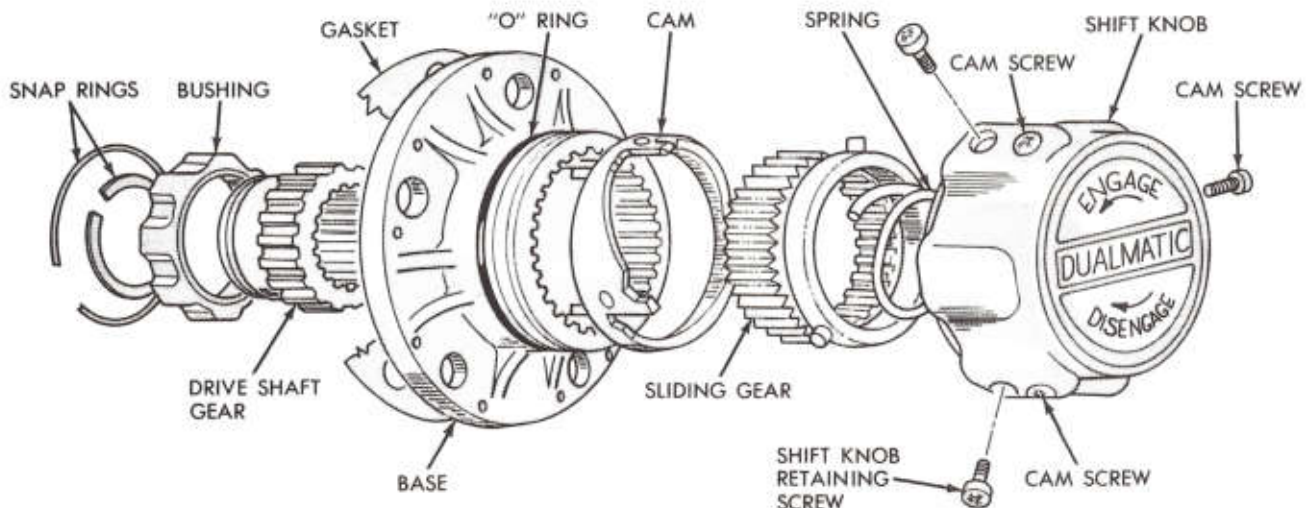


Fig. 1—Dualmatic Locking Hub

- (1) Position new gasket and locking hub onto rotor hub.
- (2) Install attaching capscrews and lock washers; tighten to 30-40 ft. lbs. (41-54 N·m).
- (3) Install axle shaft snap ring.
- (4) Position shift knob on mounting base. Align splines by pushing inward on shift knob and turning it clockwise to lock it in position.
- (5) Install and tighten three shift knob retaining screws.

WHEEL BEARING ADJUSTING PROCEDURE

- (1) Raise vehicle clear of floor and install jack stands.
- (2) Remove hub cap. Using Tool C-4020, remove snap ring.
- (3) Remove flange nuts and lock washers. Remove drive flange and discard gasket, or remove locking hub if so equipped. See dualmatic hub removal and disassembly procedures.
- (4) Straighten tang on lock ring and using Tool DD-1241-JD (Fig. 2) remove outer lock nut and lock ring.
- (5) Using Tool DD-1241-JD and Tool C-3952, tighten inner lock nut to 50 ft. lbs. (68 N·m) to seat bearings, back off lock nut and retighten to 30 to 40 ft. lbs. (41 to 54 N·m) while rotating assembly. Back nut off 135° to 150°. Assemble lock ring and outer lock nut. Tighten lock nut to 65 ft. lbs. (88 N·m) minimum. Bend one tang of lock ring over inner lock nut and one tang of lock ring over outer lock nut. Final bearing adjustment to be .001 to .010 inch (.025 to .254mm).
- (6) Install new gasket on hub. Install drive flange, lockwashers and nuts. Tighten to 30 to 40 ft. lbs. (41 to 54 N·m). Using Tool C-4020, install snap ring. Install hub cap, or install locking hub if so equipped. See dualmatic hub—assembly.
- (7) Remove jack stands, lower vehicle and test vehicle operation.

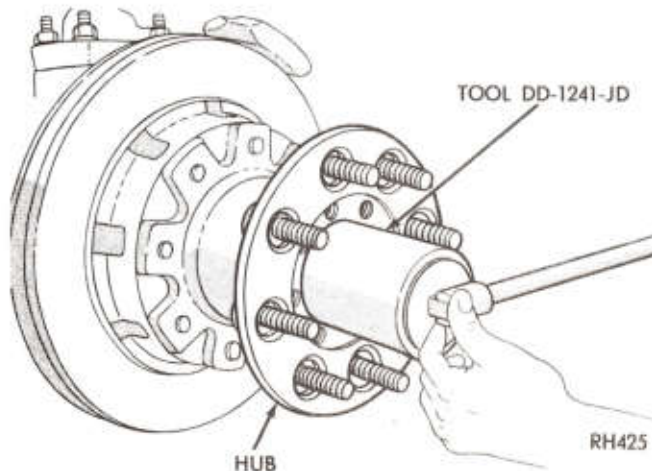


Fig. 2—Removing or Installing Outer Locknut

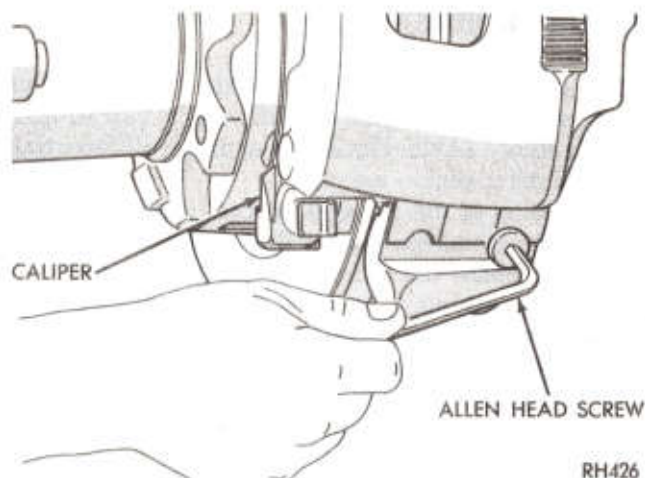


Fig. 3—Removing or Installing Allen Head Screw
SERVICING BRAKING DISC (ROTOR) OR BEARINGS

- (1) Block brake pedal in the up position.
- (2) Raise vehicle and install jack stands.
- (3) Remove wheel and tire assembly.
- (4) Remove caliper to adapter allen screw (Fig. 3).
- (5) Tap adapter lock and spring from between caliper and adapter (Fig. 4).
- (6) Carefully separate caliper from adapter. Hang caliper out of the way. **Do not allow caliper to hang or be supported by hydraulic brake hose.** Inner brake shoe will remain on adapter.
- (7) Remove hub cap. Using Tool C-4020 remove snap ring.
- (8) Remove flange nuts and lockwashers. Remove drive flange and discard gasket, or remove locking hub if so equipped. See dualmatic hub removal and disassembly procedures.
- (9) Straighten tang on lock ring and using Tool DD-1241-JD (Fig. 2), remove outer lock nut, lock ring, inner lock nut, and outer bearing. Carefully slide braking disc from spindle.

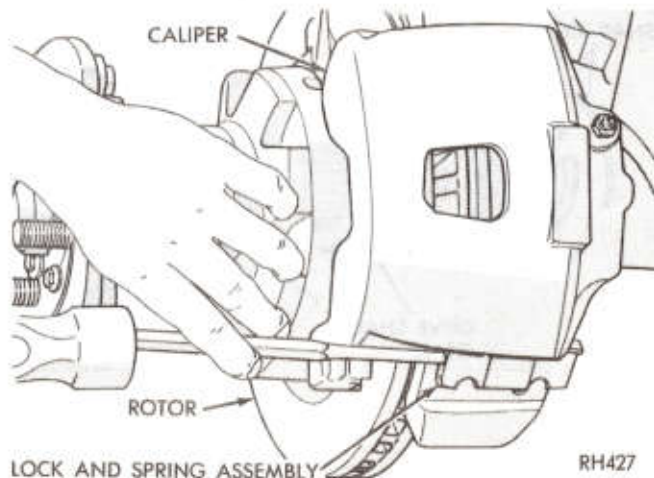


Fig. 4—Removing Caliper Lock and Spring

(10) Remove oil seal and inner bearing from hub.

(11) Thoroughly clean bearings and interior of hub, removing all old grease. **To clean bearings, soak them in cleaning solvent. Strike the flat of the bearings against a wooden block several times; immersing the bearings in the solvent between blows to jar and wash old particles of hardened grease from bearing. Repeat this operation until bearings are clean. Dry with compressed air but do not spin them with air. After cleaning, oil the bearings with engine oil. Turn the bearings slowly while applying pressure to test them for pitting and roughness. Replace all worn or defective bearings. If bearing shows pitting and roughness, replace cup and bearing. If bearings are suitable for further use, remove engine oil, pack with MOPAR Multi-Mileage Lubricant Part Number 4318062 or equivalent, and place them in a clean covered container until ready for installation. If a bearing packer is not available, hand pack grease into all cavities between cage and rollers.**

(12) If bearings and cups are to be replaced. Remove cups from the hub with a brass drift or use suitable remover.

(13) Replace bearing cups with a suitable installer.

(14) Install inner bearing in grease coated hub and install new seal with a seal installer tool. Exercise extreme care not to damage seals when installing.

(15) Carefully install braking disc onto grease coated spindle. Install outer bearing and inner lock nut.

(16) Using Tool DD-1241-JD and Tool C-3952-A, tighten to 50 ft. lbs. (68 N·m) to seat bearings, back off lock nut and retighten to 30 to 40 ft. lbs. (41 to 54 N·m) while rotating braking disc. Back nut off 135° to 150°. Assemble lock ring and outer lock nut. Tighten lock nut to 65 ft. lbs. (88 N·m) minimum. Bend one tang of lock ring over inner lock nut and one tang of lock ring over

outer lock nut. Final bearing end play to be .001 to .010 inch (.025 to .254mm).

(17) Install new gasket on hub. Install drive flange, lockwashers and nuts. Tighten to 30 to 40 ft. lbs. Using Tool C-4020 install snap ring. Install hub cap, or install locking hub if so equipped. See Dualmatic hub—assembly.

(18) Carefully position caliper onto adapter. Position adapter lock and spring between caliper and adapter and tap into position (Fig. 5). Install allen screw and tighten to 12 to 18 ft. lbs. (16-24 N·m).

(19) Install wheel and tire assembly. Tighten nuts to 75 ft. lbs. (102 N·m).

(20) Lubricate at all fittings. Remove jack stands, lower vehicle, remove block from brake pedal and test vehicle operation.

AXLE SHAFT AND JOINT ASSEMBLY

Removal

- (1) Block brake pedal in the up position.
- (2) Raise vehicle and install jack stands.
- (3) Remove wheel and tire assembly.
- (4) Remove caliper to adapter allen screw (Fig. 3).
- (5) Tap adapter lock and spring from between caliper and adapter (Fig. 4).
- (6) Carefully separate caliper from adapter. Hang caliper out of the way. **Do not allow caliper to hang or be supported by hydraulic brake hose.** Inner brake shoe will remain on adapter.
- (7) Remove hub cap and snap ring.
- (8) Remove flange nuts and lockwashers. Remove drive flange and discard gasket, or remove locking hub if so equipped. See dualmatic hub removal and disassembly procedures.
- (9) Straighten tang on lock ring and using Tool

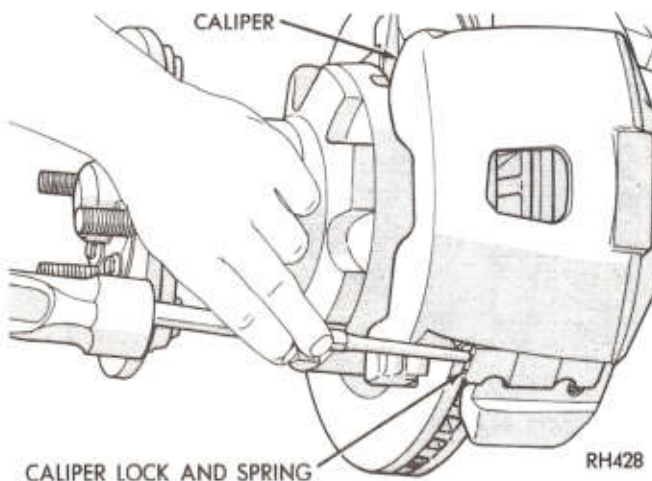


Fig. 5—Installing Caliper Lock and Spring

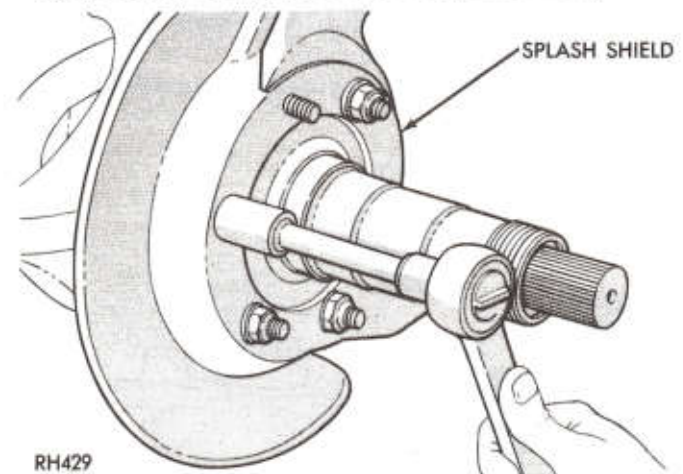


Fig. 6—Removing or Installing Spindle and Splash Shield

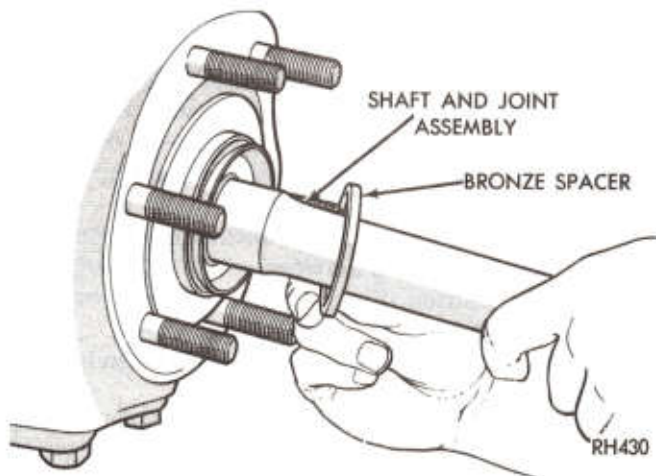


Fig. 7—Removing or Installing Shaft and Joint Assembly

DD-1241-JD remove outer lock nut, lock ring, inner lock nut and outer bearing. Carefully slide hub and rotor assembly from spindle.

(10) Remove inner brake shoe from adapter.

(11) Remove nuts and washers holding brake splash shield, brake adapter and spindle to steering knuckle (Fig. 6).

(12) Remove spindle from knuckle. Slide inner and outer axle shaft complete with bronze spacer, seal and slinger from axle (Fig. 7).

Disassembly

(1) Remove the snap rings from the two ears in each yoke.

(2) Position joint assembly in an open vise with one yoke "Horizontal" and resting on top of vise jaws (Fig. 8). Do not tighten vise.

(3) With a mallet, tap upper ear of "vertical" yoke several times, driving vertical yoke down pushing out upper needle bearing and cap.

(4) Reverse yoke and remove opposite needle bearing and cap.

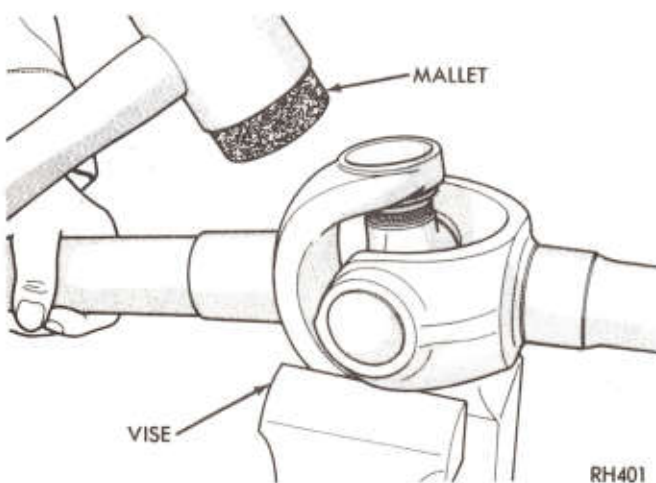


Fig. 8—Removing Bearing Caps

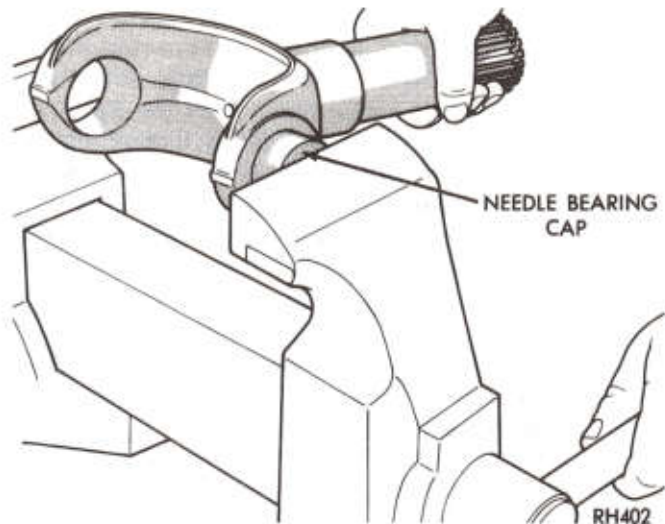


Fig. 9—Replacing Bearing Caps

(5) Work yoke off arms of cross.

(6) To complete disassembly, position open ends of cross between soft jaws of vise and repeat steps 3 and 4 to remove remaining bearings and caps.

(7) Work cross free from yoke.

(8) Clean and inspect all parts. Clean any rust from axle shaft splines. **Keep each bearing and cap assembly separate.** If any component parts are worn or damaged a new joint assembly should be installed.

(9) Repack joint with **MOPAR** Multi-Mileage Lubricant P/N 4318062 or equivalent.

Assembly

(1) Insert needle bearing and cap assembly in one ear of yoke.

(2) Place yoke in vise (Fig. 9) and press needle bearing cap into proper position. Install snap ring.

(3) Remove yoke from vise and work one arm of cross into it. Insert opposite bearing cap by hand and

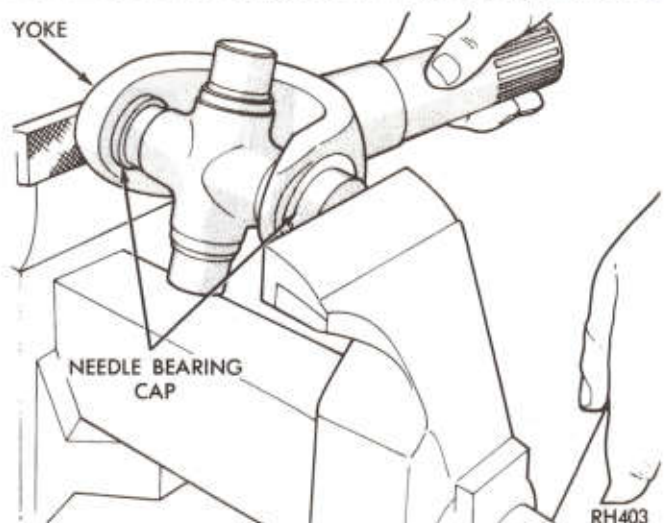


Fig. 10—Pressing Cross and Cap into Yoke

line it up with cross.

(4) Replace yoke in vise and press cap into yoke and onto arm of cross (Fig. 10).

(5) With aid of a short plug or socket, press bearing cap into proper position. Install snap ring.

(6) Repeat procedure as outlined in items 1 through 5 for installing remaining caps and yoke.

Installation

(1) Slide axle shaft into position. Position bronze spacer on axle shaft with chamfer facing toward universal joint (Fig. 7).

(2) Install spindle, brake adapter and brake splash shield. Install washers and nuts and tighten to 50 to 70 ft. lbs. (68 to 95 N·m).

(3) Position inner brake shoe on adapter.

(4) Carefully install hub and rotor assembly onto spindle. Install outer bearing and inner lock nut. Using Tool DD-1241-JD and Tool C-3952-A, tighten to 50 ft. lbs. to seat bearings, back off lock nut and retighten to 30 to 40 ft. lbs. (88 N·m) while rotating hub and rotor. Back nut off 135° to 150°. Assemble lock ring and outer lock nut. Tighten lock nut to 65 ft. lbs. (88 N·m) minimum. Bend one tang of lock ring over inner lock nut and one tang of lock ring over outer lock nut. Final bearing end play to be .001 to .010 inch (.025 to .254mm).

(5) Install new gasket on hub. Install drive flange, lock washers and nuts. Tighten to 30 to 40 ft. lbs. (41 to 54 N·m). Using Tool C-4020 install snap ring. Install hub cap, or install locking hub if so equipped. See Dualmatic hub—assembly.

(6) Carefully position caliper onto adapter. Position adapter lock and spring between caliper and adapter and tap into position (Fig. 5). Install allen screw and tighten to 12 to 18 ft. lbs. (16 to 24 N·m).

(7) Install wheel and tire assembly. Tighten nuts to 75 ft. lbs. (102 N·m).

(8) Remove jack stands, lower vehicle, remove block from brake pedal and test vehicle operation.

STEERING KNUCKLE

Removal and Disassembly

(1) Block brake pedal in the up position.

(2) Raise vehicle and install jack stands.

(3) Remove wheel and tire assembly.

(4) Remove allen screw holding caliper to adapter (Fig. 3).

(5) Tap adapter lock and spring from between caliper and adapter (Fig. 4).

(6) Carefully separate caliper from adapter. Hang caliper out of the way. **Do not allow caliper to hang or be supported by hydraulic brake hose.** Inner brake shoe will remain on adapter.

(7) Remove hub cap. Using Tool C-4020 remove snap ring.

(8) Remove flange nuts and lock washers. Remove

drive flange and discard gasket, or remove locking hub if so equipped. See dualmatic hub removal and disassembly procedures.

(9) Straighten tang on lock ring and using Tool DD-1241-JD (Fig. 2), remove outer lock nut, lock ring, inner lock nut and outer bearing. Carefully slide hub and rotor assembly from spindle.

(10) Remove inner brake shoe from adapter.

(11) Remove nuts and washers holding brake splash shield, brake adapter and spindle to steering knuckle (Fig. 6).

(12) Remove spindle from knuckle. Slide inner and outer axle shaft complete with bronze spacer, seal and slinger from axle (Fig. 7).

(13) Remove cotter key and nut from tie rod. Using Tool C-3894-A, disconnect tie rod from steering knuckle. **Left side only.** Remove cotter key and nut from drag link. Using Tool C-4150, disconnect drag link from steering knuckle arm.

(14) Remove nuts and upper knuckle cap (left side steering knuckle arm). Discard gasket. Remove spring and upper socket sleeve.

(15) Remove capscrews from lower knuckle cap. Work cap free from knuckle and housing.

(16) To remove knuckle from housing, swing out at the bottom, then lift up and off upper socket pin.

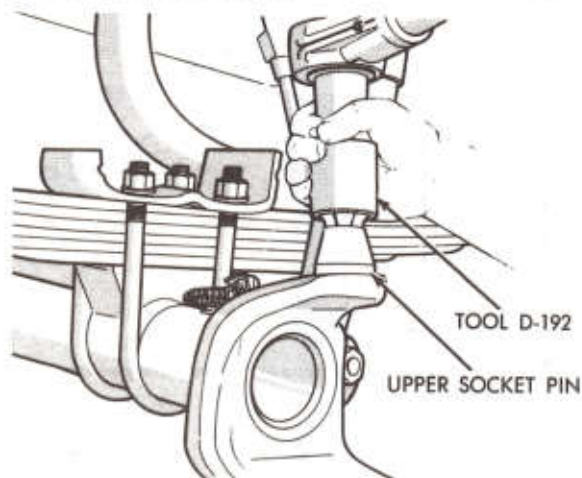
(17) Using Tool D-192 loosen and remove upper socket pin (Fig. 11). Remove seal.

(18) Using Tool C-4212-1, C-4366-1 and C-4366-2 positioned as shown in figure 12, press lower ball socket assembly from axle housing.

(19) Clean all components with a suitable solvent and blow dry with compressed air. Inspect all parts for burrs, chips, wear, flat spots or cracks. Replace necessary parts at assembly.

Assembly and Installation

(1) Lubricate lower ball socket assembly with **MOPAR** Multi-Mileage Lubricant Part Number 4318062 or equivalent.



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Fig. 11—Removing or Installing Upper Socket Pin

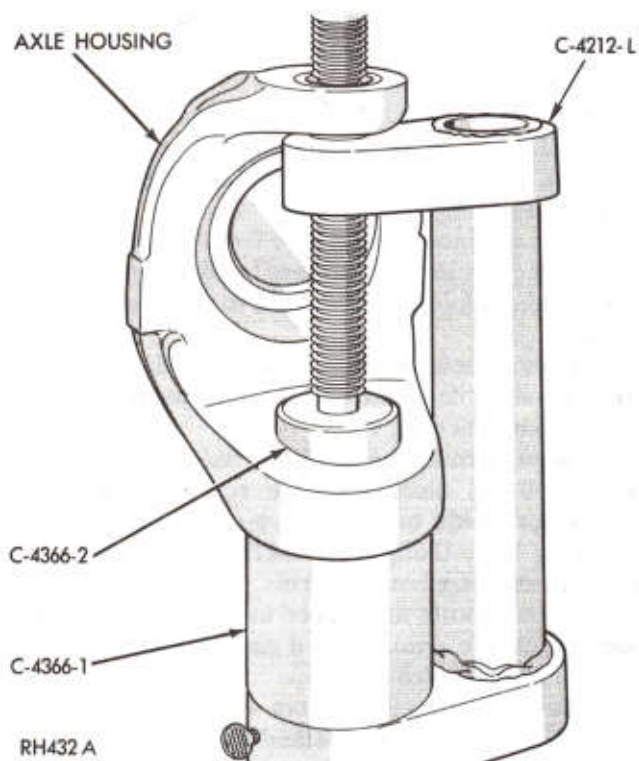


Fig. 12—Removing Lower Socket Assembly

(2) Using Tool C-4212-L, C-4366-3, and C-4366-4 positioned as shown in Figure 13, press seal and lower bearing cup into axle housing.

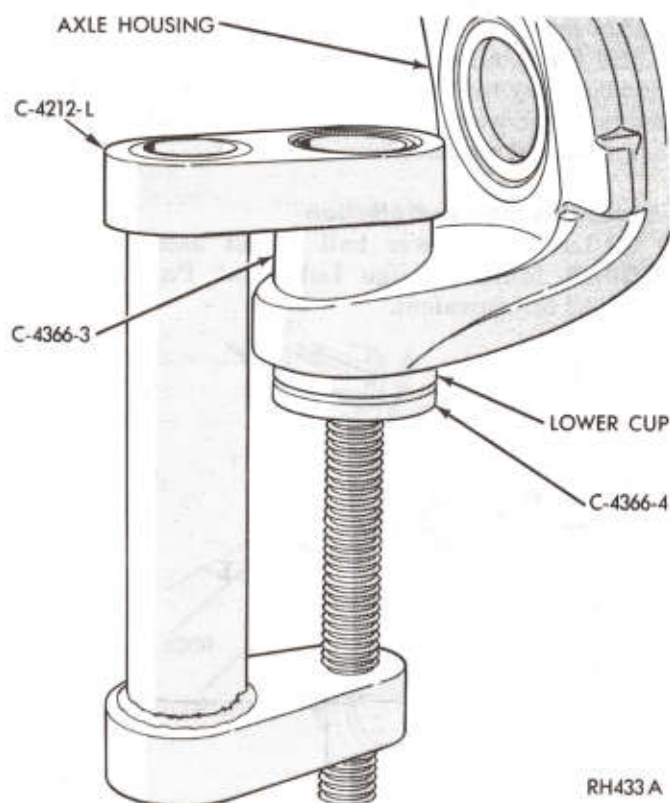


Fig. 13—Installing Seal and Lower Bearing Cup

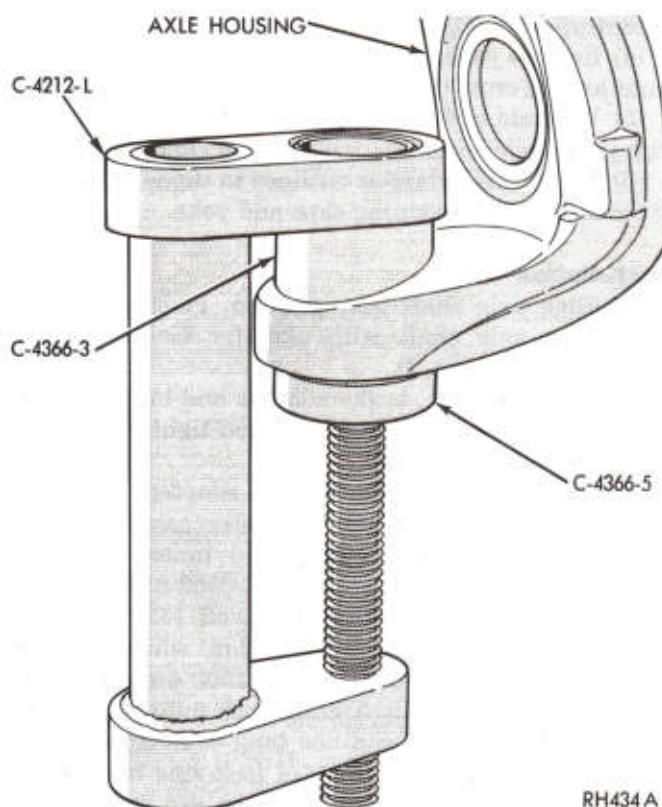


Fig. 14—Installing Lower Bearing Cone and Seal

Reposition Tool C-4212-L, C-4366-3 and C-4366-5 as shown in Figure 14, and press lower bearing and seal into axle housing.

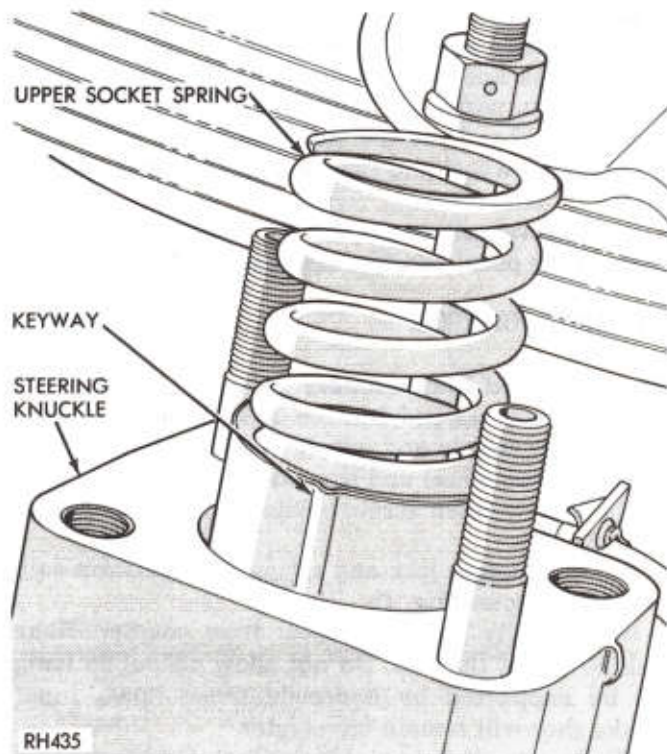


Fig. 15—Proper Alignment of Keyway on Sleeve to Steering Knuckle

(3) Using Tool D-192 and torque wrench Tool DD-994 install upper socket pin and tighten to 500 to 600 ft. lbs. (668 to 813 N·m). Install seal over socket pin.

(4) Position steering knuckle over socket pin. Fill lower socket cavity with **MOPAR** Multi-Mileage Lubricant Part Number 4318062 or equivalent. Work lower knuckle cap into place on knuckle and housing. Install capscrews and tighten to 70 to 90 ft. lbs. (95 to 122 N·m).

(5) Liberally lubricate upper socket pin with **MOPAR** Multi-Mileage Lubricant Part Number 4318062 or equivalent. Align upper socket sleeve in keyway of steering knuckle (Fig. 15) and slide into position.

(6) Install new gasket over upper steering knuckle studs. Position spring over sleeve. Install cap (left side steering knuckle arm). Install nuts and tighten to 70 to 90 ft. lbs. (95 to 122 N·m).

(7) **Left side only** connect drag link to steering knuckle arm and install nut. Tighten to 60 ft. lbs. (81 N·m). Install cotter key.

(8) Connect tie rod to steering knuckle and install nut. Tighten to 45 ft. lbs. (61 N·m). Install cotter key.

(9) Slide axle shaft into position. Position bronze spacer on axle shaft with chamfer facing toward universal joint (Fig. 7).

(10) Install spindle, brake adapter and brake splash shield. Install washers and nuts and tighten to 50 to 70 ft. lbs. (68 to 95 N·m).

(11) Position inner brake shoe on adapter.

(12) Carefully install hub and rotor assembly onto spindle. Install outer bearing and inner lock nut. Using Tool DD-1241-JD and Tool C-3952-A, tighten to 50 ft. lbs. (68 N·m) to seat bearings. Back off lock nut and retighten to 30 to 40 ft. lbs. (41 to 54 N·m) while rotating hub and rotor. Back nut off 135° to 150°. Assemble lock ring and outer lock nut. Tighten lock nut to 65 ft. lbs. (88 N·m) minimum. Bend one tang of lock ring over inner lock nut and one tang of lock ring over outer lock nut. Final bearing end play to be .001 to .010 inch (.025 to .254mm).

(13) Install new gasket on hub. Install drive flange, lockwashers and nuts. Tighten to 30 to 40 ft. lbs. (41 to 54 N·m). Using Tool C-4020 install snap ring. Install hub cap, or install locking hub if so equipped. See Dualmatic hub—assembly.

(14) Carefully position caliper onto adapter. Position adapter lock and spring between caliper and adapter and tap into position (Fig. 5). Install allen screw and tighten to 12 to 18 ft. lbs. (16 to 24 N·m).

(15) Install wheel and tire assembly. Tighten nuts to 75 ft. lbs. (102 N·m).

(16) Lubricate at all fittings. Remove jack stands, lower vehicle, remove block from brake pedal and test vehicle operation.

STEERING KNUCKLE ARM

Removal

- (1) Raise vehicle and install jack stands.

(2) Turn wheels to the left. Remove cotter key and nut and disconnect drag link. See "Drag Link," "Removal" in this group.

(3) Remove the four steering knuckle arm to steering knuckle mounting nuts and carefully remove steering knuckle arm.

Installation

(1) Position steering knuckle arm over studs of steering knuckle. Install nuts and tighten to 70 to 90 ft. lbs. (95 to 122 N·m).

(2) Install drag link to steering knuckle arm. Install nut and tighten to 60 ft. lbs. (81 N·m). Install cotter key.

(3) Remove jack stands. Lower vehicle and test operation.

DRAG LINK

Drag link seals should be inspected for damage at all oil change periods.

Damaged seals require removal of the seals and inspection of the drag link assembly at the throat opening. If the parts have not lost all the lubricant or are not contaminated, worn or rusted, use new seals and reinstall, otherwise, a new complete drag link assembly should be installed. Lubricate after assembly with **MOPAR** Multi-Mileage Lubricant Part Number 4318062 or equivalent.

Removal

Removal of drag link from steering knuckle arm or steering gear arm by methods other than using Tool C-4150 could damage seals.

- (1) Raise vehicle and install jack stands.
- (2) Turn wheels in direction to give best possible access to drag link. Remove cotter keys and nuts.
- (3) Install puller Tool C-4150 (Fig. 16). Apply sufficient pressure with tool to free drag link from steering knuckle arm and steering gear arm. Lower drag link from vehicle.

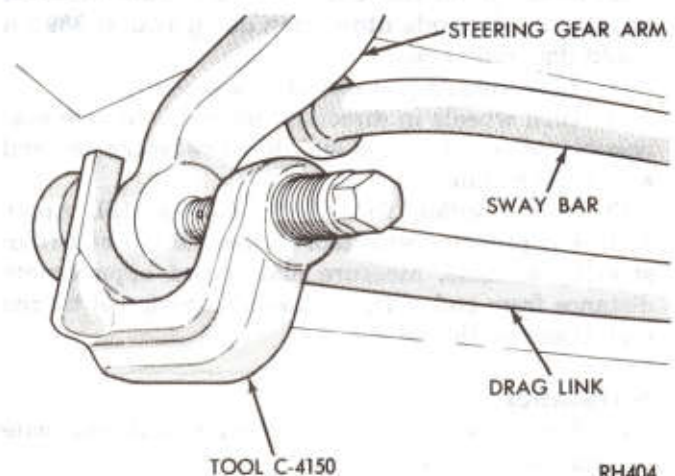


Fig. 16—Removing Drag Link with Tool C-4150

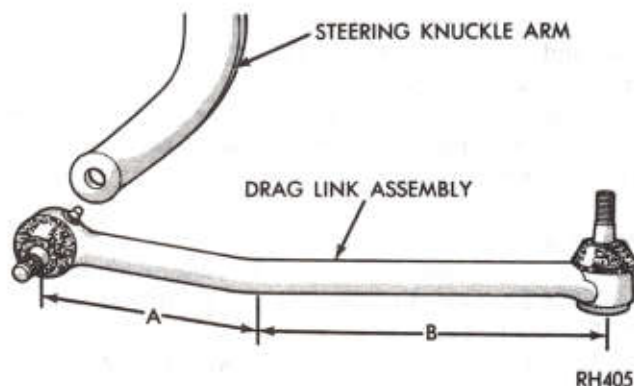


Fig. 17—Proper Installation of Drag Link Assembly

Installation

(1) Position drag link to steering knuckle arm (Fig. 17) so that from production bend in arm to steering knuckle arm is the short distance marked as "A" in Figure 17 and long distance from bend marked "B" in Figure 17 is to be installed to steering gear arm.

(2) Install and tighten nuts to 60 ft. lbs. (81 N·m). Install cotter keys.

(3) Lubricate at fittings. Remove jack stands and lower vehicle.

TIE ROD END

Tie rod end seals should be inspected for damage at all oil change periods.

Damaged seals require removal of the seals and inspection of the tie rod end assembly at the throat opening. If the parts have not lost all the lubricant or are not contaminated, worn or rusted, use new seals and reinstall, otherwise a new complete tie rod end assembly should be installed. Lubricate after assembly with **MOPAR** Multi-Mileage Lubricant Part Number 4318062 or equivalent.

Removal

Removal of tie rod end assembly from steering knuckle by methods other than using Tool C-3894-A could damage seals.

(1) Raise vehicle and install jack stands.

(2) Turn wheels in direction necessary to give best possible access to tie rod end. Remove cotter key and nut. Loosen clamping bolt nut.

(3) Install puller Tool C-3894-A (Fig. 18). Apply sufficient pressure with tool to free tie rod end from steering knuckle. Measure and record approximate distance from end of tie rod to outside edge of tie rod end. Unscrew tie rod end.

Installation

(1) Screw new tie rod end into tie rod to approximate distance previously recorded.

(2) Connect tie rod end to steering knuckle and install nut. Tighten to 45 ft. lbs. (61 N·m) and install

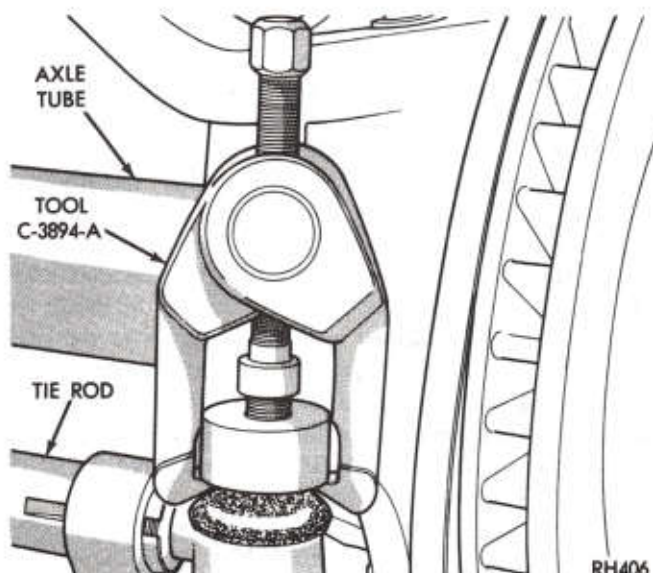


Fig. 18—Removing Tie Rod with Tool C-3894-A

cotter key. Remove jack stands and lower vehicle. Adjust toe-in to 1/8 inch (3mm). Position clamping bolt to bottom of tie rod. Tighten clamping bolt nut to 25 to 30 ft. lbs. (34 to 41 N·m). Test vehicle operation.

AXLE ASSEMBLY

Removal

(1) Block brake pedal in the up position. Raise vehicle to a comfortable working height and install jack stands.

(2) Disconnect front propeller shaft at drive pinion yoke.

(3) Disconnect drag link at steering knuckle arm (left side only).

(4) Disconnect flexible hydraulic brake line at frame crossmember. Plug lines at fittings.

(5) Disconnect shock absorbers at lower mounts.

(6) Remove nuts and washers from "U" bolt spring clips. Remove axle assembly from vehicle.

Installation

(1) Position axle under vehicle. Locate spring clip plates over springs. Install spring clip "U" bolts, washers and nuts. Tighten to 110 ft. lbs. (149 N·m).

(2) Connect shock absorbers at lower mounts. Install nuts and tighten to 55 ft. lbs. (75 N·m).

(3) Remove plugs and connect hydraulic brake line. Tighten to 80-150 in. lbs. (9-17 N·m).

(4) Connect drag link to steering knuckle arm. Install castellated nut and tighten to 60 ft. lbs. (81 N·m). Align cotter key hole in stud and slot in castellated nut, if slot and hole are not aligned continue to tighten nut until aligned. **Do not loosen to align.** Install cotter key.

(5) Connect prop shaft at drive pinion yoke. Install washers and nuts and tighten to 300 in. lbs. (34 N·m).

(6) Remove jack stands, lower vehicle, remove block from brake pedal.

(7) Raise vehicle, bleed brakes, lubricate at all fittings, check axle lubricant level. See "Lubrication and Maintenance" Group 0 of this manual for proper level and type of lubricant required.

(8) Lower vehicle and test operation.

DIFFERENTIAL CASE AND DRIVE PINION

Removal and Disassembly

A close examination of the axle assembly prior to disassembly can often reveal valuable information as to the extent and type of repairs or adjustments necessary. Since the most frequent causes of axle noise are improper backlash or differential bearing preload, or both, a few simple adjustments may be all that is necessary to correct the deficiency.

Therefore, before disassembly the following checks should be made; drive gear and pinion backlash, pinion bearing preload, and tooth contact pattern and these results recorded and analyzed. It is felt that these measurements will aid you in making the necessary repairs to the axle assembly. See appropriate are of this group for proper procedures.

If after these tests and adjustments the deficiency was not corrected then proceed as follows.

(1) Thoroughly clean the outer area of carrier and tubes with a suitable cleaning solvent and blow dry with compressed air.

(2) Loosen and remove cover screws and remove carrier cover. Drain lubricant into a container.

(3) Using a suitable cleaning solvent wash and clean differential, bearings, gear ring and pinion and internal surfaces and blow dry with compressed air.

(4) In preparing to measure drive gear back face runout (provided no side play was found) mount a dial indicator Tool C-3339 on pilot stud (Fig. 19), and load the indicator stem slightly with plunger at right angles to back face of drive gear.

(5) Measure drive gear back face runout by rotating drive gear several complete revolutions and reading

dial indicator. Mark drive gear and differential case at point of maximum runout. The marking of differential case will be very helpful later in checking differential case runout. Total indicator readings in excess of .006 inch (.152mm) might indicate possible loose drive gear or damaged differential case. A test for differential case runout will be described later.

(6) Check the clearance between the differential bearing cap and bearing cup by trying to insert a piece of .003 inch (.076mm) feeler stock between them. A .003 inch (.076mm) feeler should not enter between the bearing cap and cup. A clearance of more than .003 inch (.076mm) could be caused by bearing cup having turned in carrier, causing excessive wear.

(7) Note identifying letters stamped on bearing caps and face of carrier housing seal surface (Fig. 20). Letters stamped on left side are in horizontal position while right side are in vertical position. Always match identifying letters for proper reassembly.

(8) Loosen and remove the differential bearing caps and locate spreader Tool W-129-A with tool dowel pins seated in locating holes of axle housing. Turn tool screw finger tight at this time.

(9) Install pilot stud on left side of axle housing. Attach dial indicator and load indicator stem slightly against opposite side of axle housing (Fig. 21).

(10) Tighten spreader tool nut sufficiently to obtain .015 inch (.381mm) movement of dial indicator to permit removal of differential case and ring gear assembly.

DO NOT SPREAD OVER .020 INCH (.508mm) AS IT WILL RESULT IN PERMANENT DAMAGE TO CARRIER CASTING.

(11) Remove dial indicator and remove differential case and ring gear assembly from axle housing. A light prying action with a screwdriver or pinch bar will loosen assembly for easy removal. Pry up differential case and ring gear as straight up as possible using leverage against differential case and carrier to prevent damage. Keep respective bearing cups with bearing

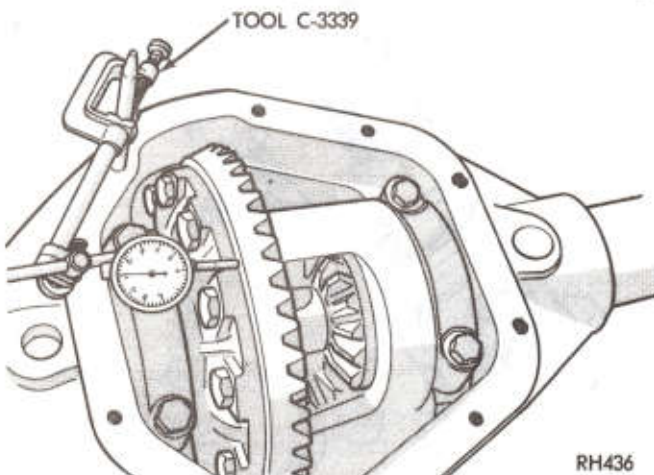


Fig. 19—Measuring Drive Gear Runout

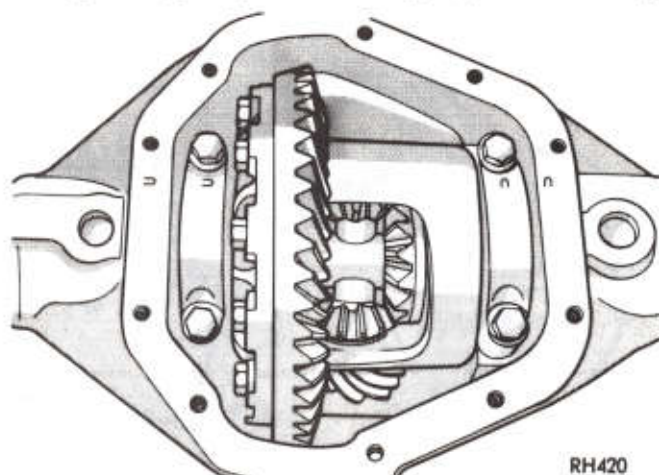


Fig. 20—Bearing Cap Identification

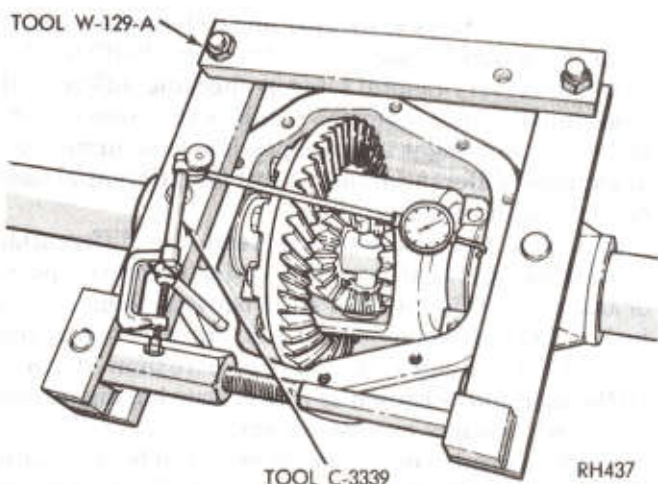


Fig. 21—Spreading Axle Housing

cones, if they are not worn or damaged and are to be reassembled.

(12) Place the differential case between the soft jaws of a vise and remove and **DISCARD** the drive gear screws. Using a fiber mallet, tap the drive gear loose from the differential case pilot and remove.

(13) If the drive gear runout exceeded .006 inch (.152mm) in step (5) differential case flange runout should be remeasured. Install differential case with respective bearing cups into axle housing. Loosen nut of spreader tool and remove. Install bearing caps and tighten snugly. Mount dial indicator in contact with flange face of differential case (Fig. 22) and measure runout as described in step 5. Total allowable runout should not exceed .003 inch (.076mm). It is often possible to reduce excessive runout by positioning drive gear 180 degrees from point of maximum runout when reassembling ring gear on differential case. Repeat steps 8, 9, 10 and 11 above.

(14) Remove drive pinion nut and washer. Using Tool C-452 and holding Tool C-3281, remove drive pinion flange.

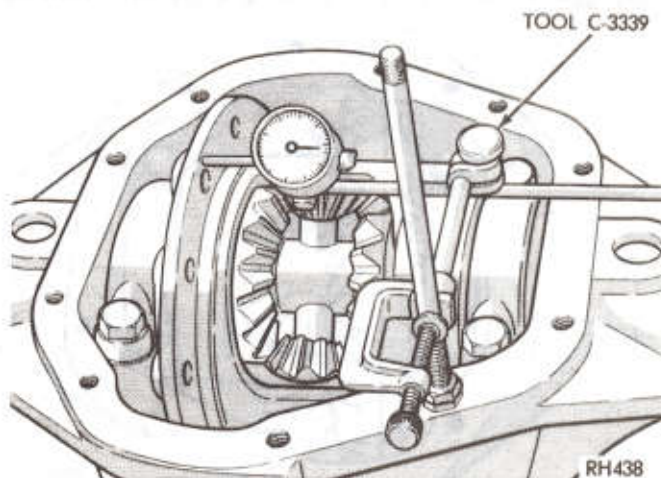


Fig. 22—Measuring Differential Case Drive Gear Mounting Flange Face Runout

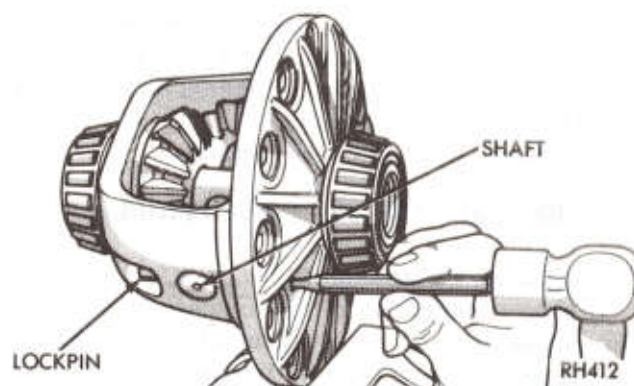


Fig. 23—Removing Differential Pinion Shaft Lockpin (Typical)

(15) Using Tool C-748, remove drive pinion oil seal. Remove slinger, gasket, front pinion bearing cone and preload shim pack. Record the thickness of the shims in case they should be lost.

(16) Press out the drive pinion and rear bearing cone assembly.

(17) Using Tool D-158 and Handle C-4171, remove front pinion bearing cup. Using Tool D-162 and Handle C-4171 remove rear pinion bearing cup. Remove and record thickness of shim pack from behind rear pinion bearing cup.

(18) Remove rear bearing cone from drive pinion stem using Tool DD-914-P Adapter Ring DD-914-9 and C-293-37 adapters (or Tool C-293-P and adapters C-293-37).

(19) Place differential case in a vise equipped with soft jaws. Drive out lock pin securing differential pinion shaft to case (Fig. 23).

(20) Remove differential pinion mate shaft, differential pinion mates and thrust washer (one back of each pinion). Remove differential side gears and thrust washers (one back of each gear).

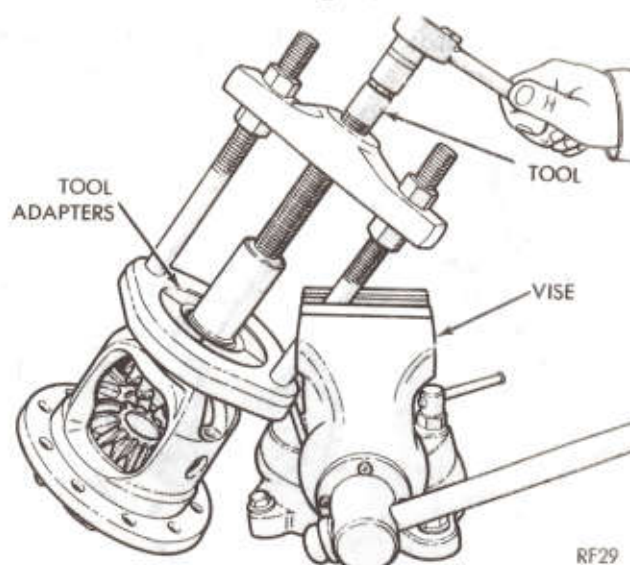


Fig. 24—Removing Differential Bearings (Typical)

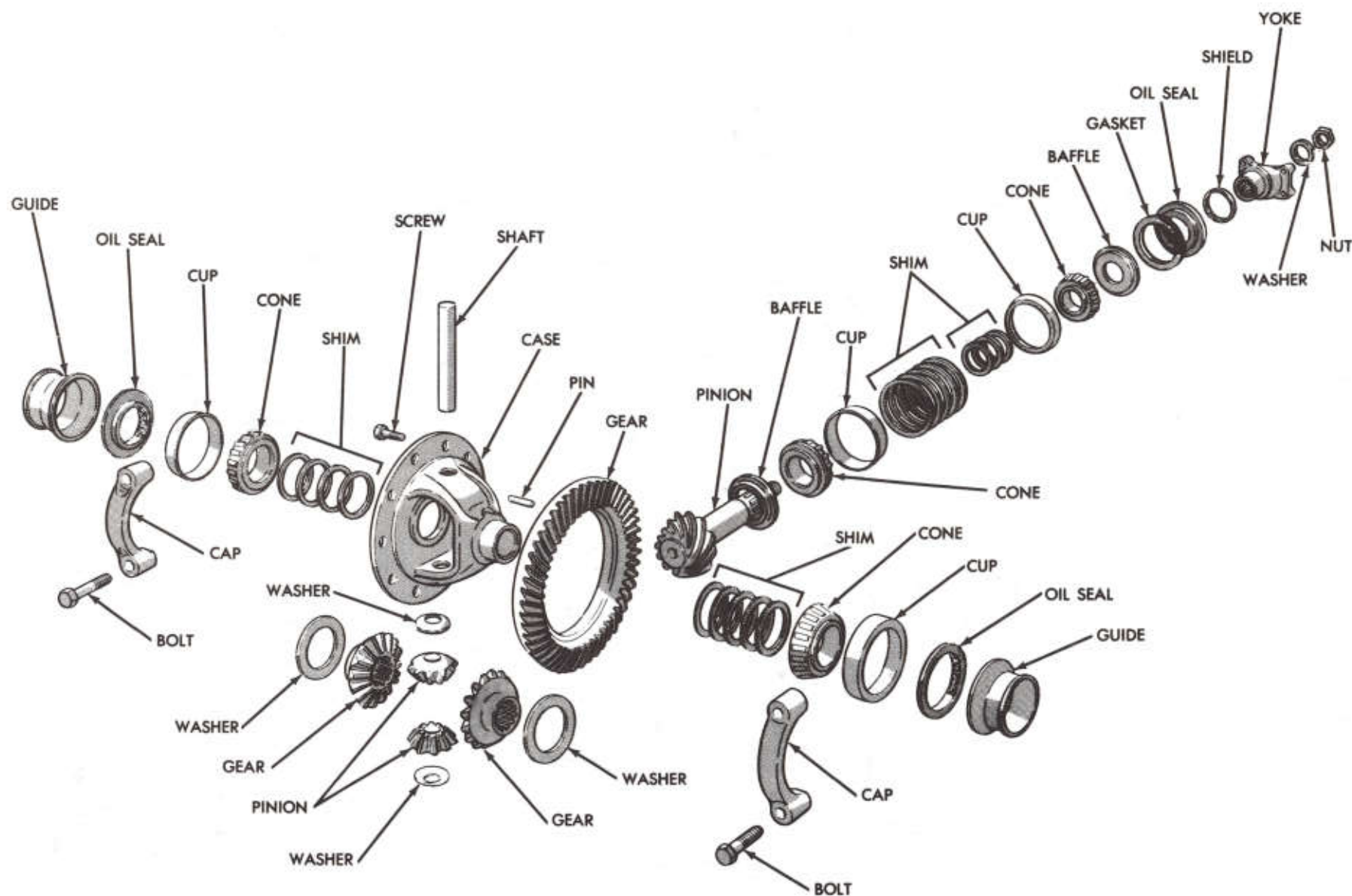


Fig. 25—Differential, Front Driving (60) Axle

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(21) Using Tool DD-914-P, adapter ring DD-914-8, DD-914-7 extension, DD-914-42 button, and DD-914-62 adapters, remove differential cones from case (Fig. 24). Care must be taken to insure that bearing remover adapters are located so as not to pull on bearing cage.

(22) Remove the shims located behind each bearing and record thickness and respective side to aid in reassembly.

(23) Remove axle shaft inner oil seals.

Cleaning and Inspection

(1) Wash and clean all parts in a suitable cleaning solvent and with the exception of bearing cones, dry with compressed air. To clean axle housing tubes, insert a stiff wire into tube, attach a clean cloth to wire at center section and withdraw from center outward. Do not steam clean. Figure 25 shows a disassembled view of the differential assembly.

(2) All machined contact surfaces in the axle housing and differential bearing caps should be smooth and free of any raised edges. Front and rear pinion bearing cup bore machine surfaces should be smooth. Raised metal on shoulders of bores incurred in removal of cups should be removed with a hand stone.

(3) Differential bearings and front and rear pinion bearing cone and cup assemblies should have a smooth appearance with no broken or dented surfaces on rollers or roller contact surfaces. The bearing roller retainer cages must not be distorted or cracked. **When replacing bearings, always replace the cup and cone in a set only.**

(4) Examine differential pinion mate shaft, pinion mates, side gears and thrust washers for wear or damage, replace all defective parts. **Pinion mates should be replaced in sets. Do not replace one mate only.**

(5) Inspect drive gear and pinion for worn or chipped teeth or damaged attaching bolt threads. If replacement is necessary, replace both the drive gear and drive pinion as they are available in matched sets only.

(6) Inspect universal joint flange for cracks, worn splines, pitted, rough or corroded oil seal contacting surface. Repair or replace universal joint flange as necessary.

(7) Inspect drive pinion bearing shim pack for broken, damaged or distorted shims. Replace, if necessary, during establishment of pinion bearing preload.

Assembly and Installation

(1) Lubricate all parts with differential lubricant. Install differential side gears and thrust washers, pinion mates and thrust washers and pinion mate shaft in differential case. Align hole in shaft with hole in case. Drive in lock pin. **If new gears and washers are used, it will not be necessary to check gear backlash. Correct fit is provided due to close manufacturing tolerances.** Position drive gear on differential case

pilot, aligning threaded holes of drive gear with those in differential case flange.

(2) Insert new drive gear screws through case flange and into the drive gear. After all cap screws are properly started, tap drive gear against differential case flange with a non-metallic mallet.

(3) Clamp unit between brass jaws of a vise and alternately tighten each cap screw to 110-115 ft. lbs. (149-156 N·m).

(4) Install master differential bearings Tool D-117 onto case (Fig. 26).

(5) Insert differential case in carrier. Install bearing caps in their correct positions and tighten bearing cap bolts finger tight.

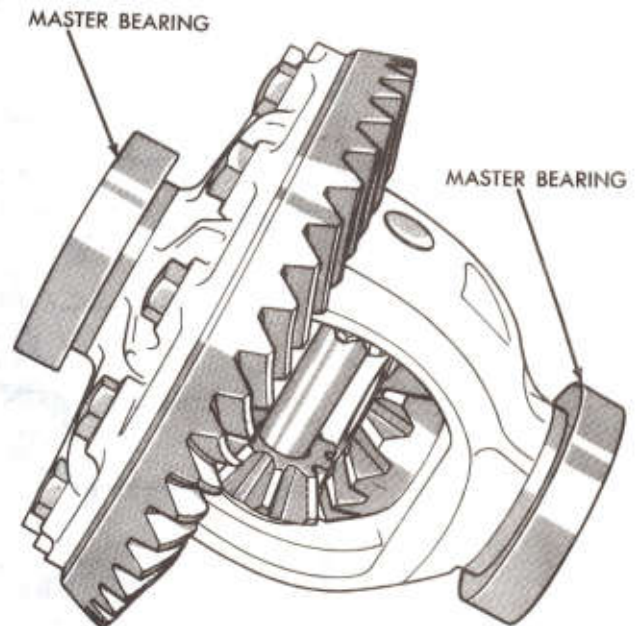
(6) Install dial indicator fixture with indicator pointer contacting back face of drive gear.

(7) Insert a screwdriver blade between bearing cup and housing and pry case assembly as far as possible to one side of housing (Fig. 27). Set dial indicator at zero. Using screwdriver, pry case to opposite side of housing and record the reading.

This reading indicates the amount of shims needed to take up the clearance between the differential bearing cups and the case. The shim pack thickness to be placed on bearing hub between bearing cone and differential case will be calculated later in the procedure after installation of drive pinion and depth of mesh setting.

(8) Remove dial indicator, loosen bearing cap bolts and remove bearing caps. Remove differential assembly from housing.

(9) Install axle shaft inner oil seals with Tool C-4026-A and Handle C-4171.



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Fig. 26—Differential Master Bearings Installed

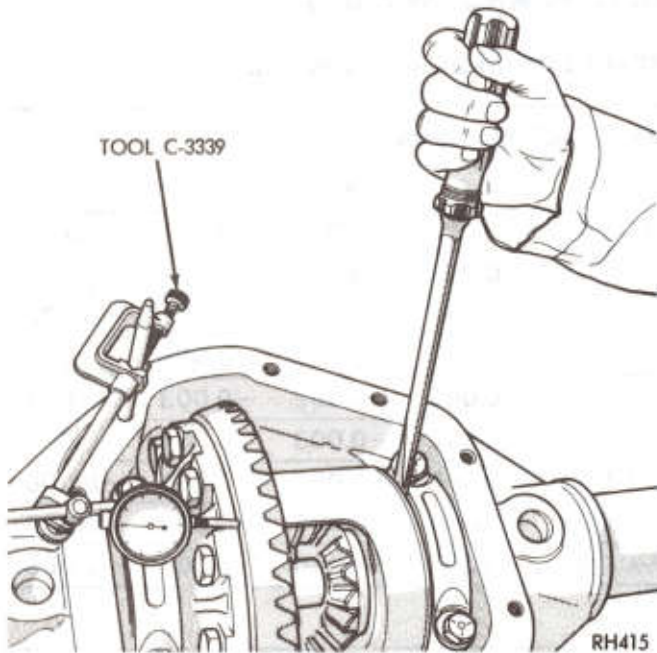


Fig. 27—Determining Shims to Obtain "0" End Clearance

DRIVE PINION DEPTH OF MESH SETTING

(Using Pinion Depth Gauge Tool Set D-271)
(Fig. 28)

Ring gears and pinions are supplied in matched sets only. Matching numbers on both the pinion and ring gear are etched for verification.

On the face of each pinion there is etched either a

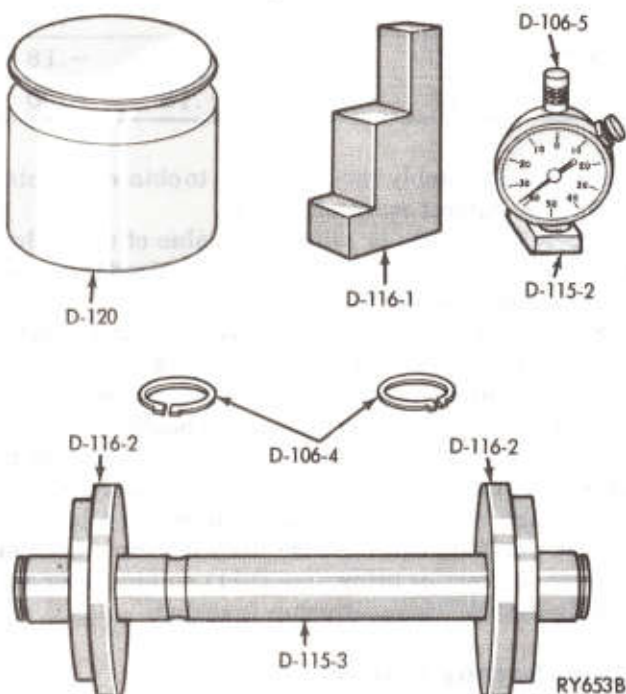


Fig. 28—Pinion Depth Gauge Tools from D-271

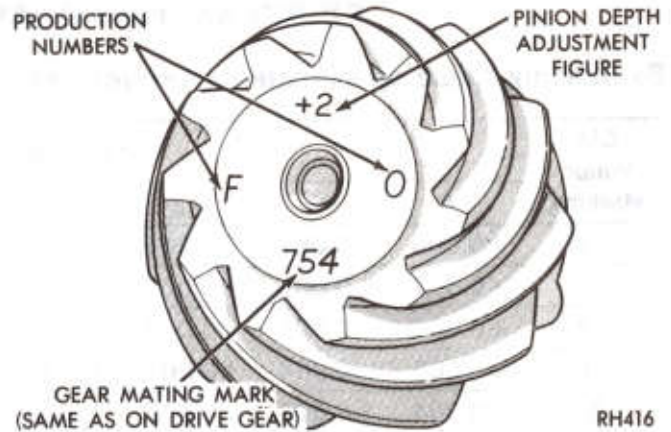


Fig. 29—Drive Pinion Markings

plus (+) number, or a minus (−) number, or "0" which indicates the best running position for each particular gear set. This dimension is controlled by shimming behind the inner pinion bearing cup. (Fig. 29).

The distance from the center line of the ring gear to the face of the pinion is 3.125" (79.37 mm) (Fig. 30).

If the etched figure is "0" the shim pack will remain unchanged.

For example—if a pinion is etched +3 (m + 8) this pinion would require .003" (.08mm) less shims than a pinion etched "0". By removing shims, the mounting distance of the pinion is increased to 3.128" (79.45mm), which is what a +3 (m + 8) indicates. Or if a pinion is etched −3 (m − 8) we must add .003" (.08mm) more shims than would be required if the pinion were etched "0". By adding .003" (.08mm) shims the mounting distance of the pinion is decreased to 3.122" (79.29 mm) which is what a −3 (m − 8) indicates.

If a new gear set is being used, notice the (+) or (−) etching on both the old and new pinion and adjust the thickness of the new shim pack to compensate for the difference of these two figures.

For example—if the old pinion reads (+) 2 (m + 5) and the new pinion is (−) 2 (m − 5), add .004" (.10mm) shims to the original shim pack.

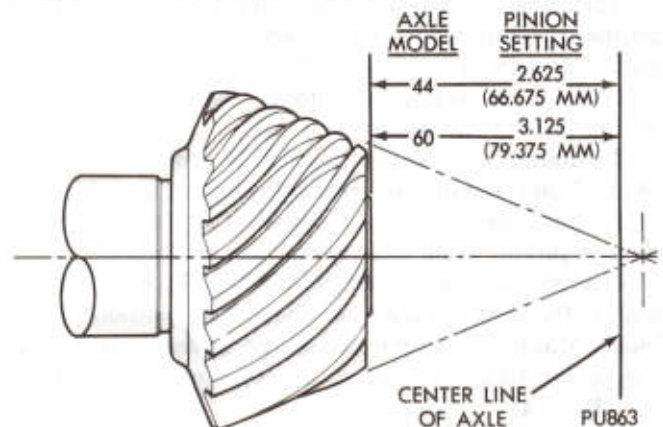


Fig. 30—Pinion Setting Dimension

PINION SETTING CHARTS (U.S. AND METRIC)

By utilizing these specifications, proper gear contact should be established.

Old Pinion Marking	New Pinion Marking (U.S. Standards)								
	-4	-3	-2	-1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003
0	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004
-1	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005
-2	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006
-3	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007
-4	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007	-0.008

Old Pinion Marking	New Pinion Marking (Metric)								
	-10	-8	-5	-3	0	+3	+5	+8	+10
+10	+.20	+.18	+.15	+.13	+.10	+.08	+.05	+.03	0
+8	+.18	+.15	+.13	+.10	+.08	+.05	+.03	0	-.03
+5	+.15	+.13	+.10	+.08	+.05	+.03	0	-.03	-.05
+3	+.13	+.10	+.08	+.05	+.03	0	-.03	-.05	-.08
0	+.10	+.08	+.05	+.03	0	-.03	-.05	-.08	-.10
-3	+.08	+.05	+.03	0	-.03	-.05	-.08	-.10	-.13
-5	+.05	+.03	0	-.03	-.05	-.08	-.10	-.13	-.15
-8	+.03	0	-.03	-.05	-.08	-.10	-.13	-.15	-.18
-10	0	-.03	-.05	-.08	-.10	-.13	-.15	-.18	-.20

If the old ring and pinion set is to be reused, measure the old shim pack and build a new shim pack to this same dimension. If a baffle is used in the axle assembly, its thickness is considered as part of the shim pack. Shims are available in thicknesses of .003", .005", .010", and .030" (.08, .13, .25, and .76mm).

(1) Place master pinion block Tool D-120 into the pinion bore of the carrier (Fig. 31).

(2) Mount arbor discs Tool D-116-2 on Arbor Tool D-115-3 and install into cross bores of carrier (Fig. 32).

(3) Place pinion height block Tool D-116-1 on top of master pinion block and against arbor (Fig. 33).

(4) Position gage assembly Tool D-115-2 gauge block and D-106-5 dial indicator on small step of pinion height block. Making sure that the gauge assembly is flat on the pinion height block, set the dial indicator to read "0" (Fig. 34).

(5) With indicator set at "0", move the gauge assembly so that the tip of dial indicator stem contacts arbor.

Move gauge assembly back and forth to obtain indicator reading at highest point of contact.

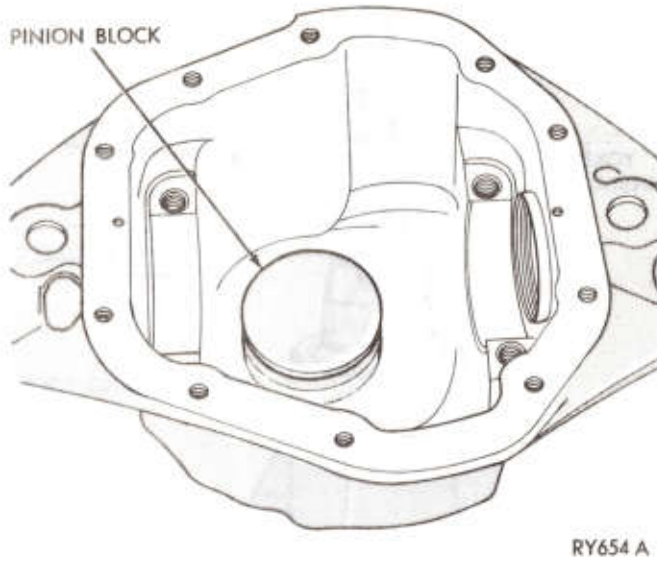
This reading, plus or minus the value of the etched figure on the face of the pinion is the required thickness of the pinion bearing shim pack.

(6) Measure each shim separately with a micrometer and add together to get total shim pack thickness. If baffle is required, its thickness is to be included in shim pack. If slinger is used between inner bearing cone and thrust face of pinion, slinger thickness is also to be measured and included as part of the total shim pack.

Place the required amount of shims (and baffle if used) in the inner bearing bore; drive the inner bearing cup into the carrier using Tool D-111 cup installer and Handle C-4171. Make sure cup is seated.

Pinion Bearing Preload

(1) Using Tool C-4203 and Tool C-4171, drive the outer pinion bearing cup into the carrier (Fig. 35).



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Fig. 31—Master Pinion Block Installed in Pinion Bore

(2) Drive or press inner bearing onto shaft until it is completely seated using Tool C-3095-A (Fig. 36).

(3) Install pinion into carrier followed by the outer pinion bearing cone, (slinger if used), end yoke, washer and nut. Use Tool C-3718 and Tool C-3281 (Fig. 37).

Do not assemble preload shims or pinion oil seal at this time.

(4) Using inch-pound torque wrench, rotate pinion. Tighten yoke nut until it requires 10 in. lbs. (1.13 N·m) to rotate pinion (Fig. 38).

(5) Recheck pinion depth at this time by placing arbor and discs (small diameter discs for Model 60 axle and large diameter used on Model 70 axle) into cross bore of carrier. Place pinion height block on face of pinion. Set dial indicator on small step of height block. (High step of block is used for Model 70 axle). Set dial

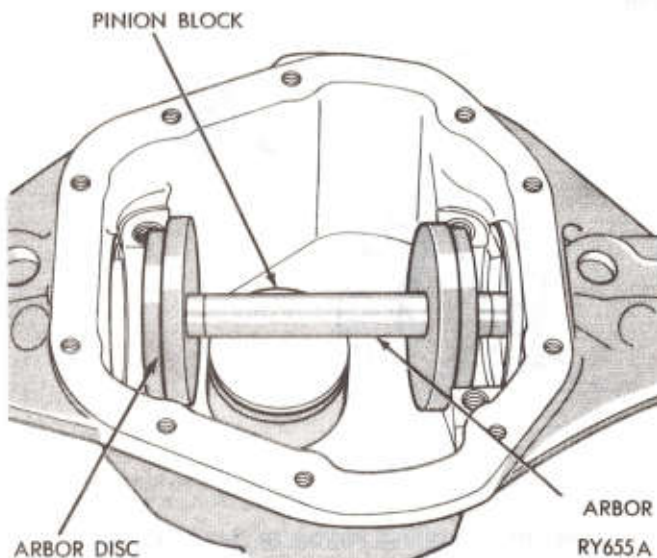


Fig. 32—Arbor Discs and Arbor in Position

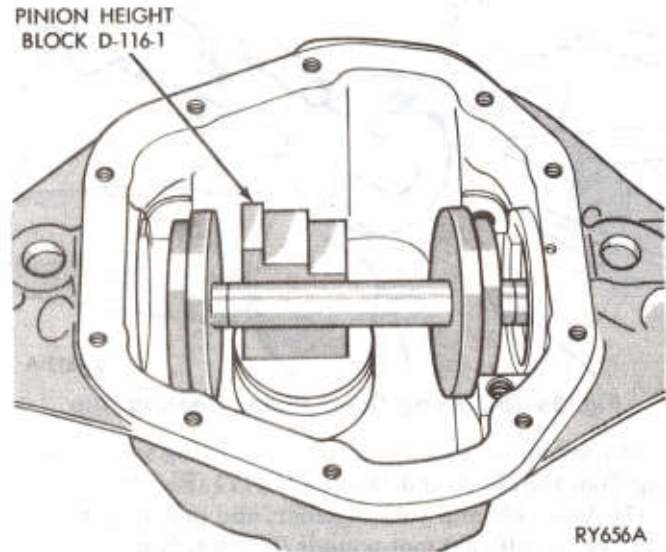


Fig. 33—Pinion Height Block Positioned Against Arbor

indicator at "0". Slide gauge assembly across or over arbor (Fig. 34).

Indicator will read a plus (+) or minus (−) at its highest point, depending on the etched figure on the pinion.

Indicator reading within .002 inch (.05mm) of etching is considered acceptable. If pinion position is found to be within specifications continue with build up. If pinion position is not within specifications change shim pack thickness under inner bearing cup.

(6) Remove pinion nut, washer, end yoke, slinger, and bearing cone. Assemble preload shims (which were removed during disassembly) onto pinion. Assemble bearing cone, and slinger.

Apply a light coat of hypoid lubricant on the lip of

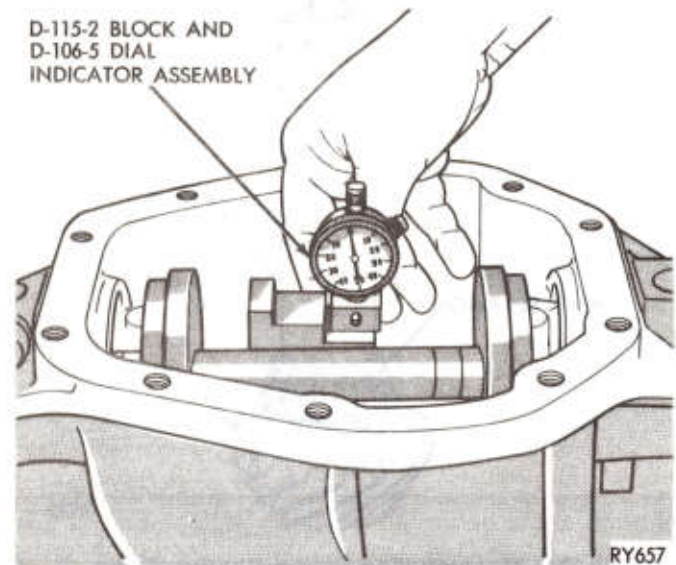


Fig. 34—Checking Pinion Depth

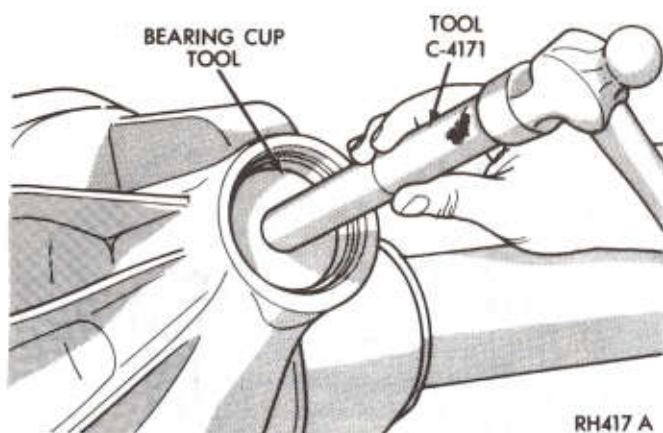


Fig. 35—Installing Outer Pinion Bearing Cup

pinion seal and assemble into carrier using seal installing Tool C-3719-A and Handle C-4171 (Fig. 39).

(7) Assemble end yoke, washer, and new pinion nut. Tighten to 240-300 foot-pounds (325-406 N·m).

(8) Using an inch pound torque wrench as shown rotate pinion. Torque required to rotate pinion should read between 20-40 inch pounds (2.26-4.53 N·m). To increase preload, remove shims; to decrease preload add shims.

The illustration in Figure 40 shows the arrow in the pinion pointing in two directions. The direction pointing towards the end yoke indicates that by removing pinion position shims, the distance from the centerline of the axle to pinion face is increased giving a plus reading. The preload shim pack does not effect the pinion depth setting. Arrows on the ring gear illustrate the method to increase or decrease backlash and differential bearing preload.

(9) With master bearing Tool D-117 installed on the

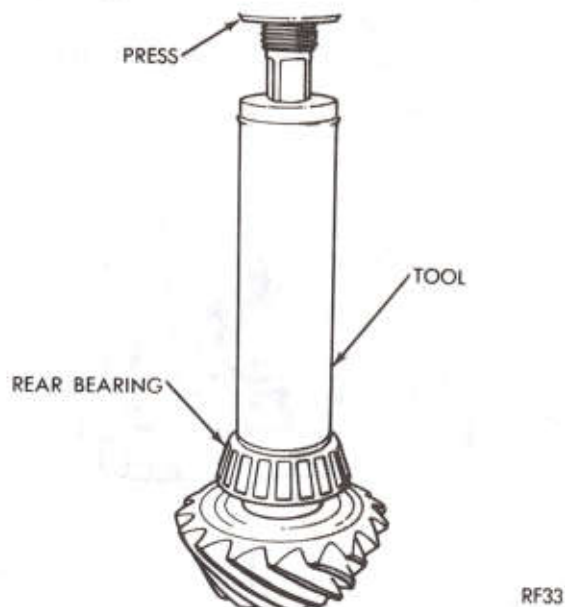


Fig. 36—Installing Pinion Bearing Cone

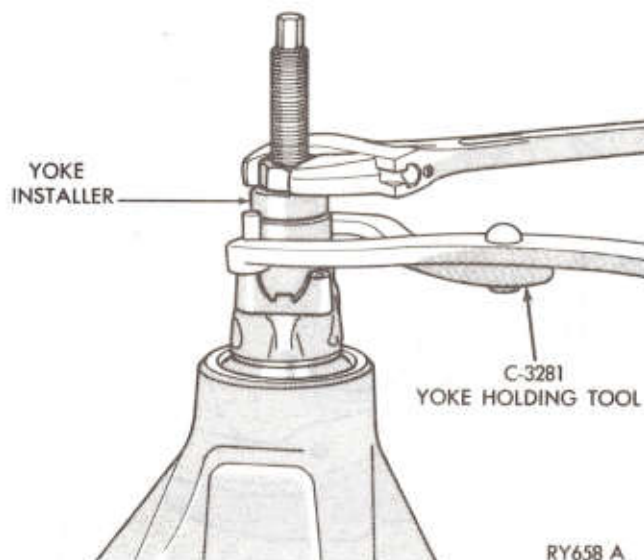


Fig. 37—Installing Pinion and Yoke

differential case, place assembly into housing.

(10) Set up dial indicator as shown in (Fig. 27). Press ring gear into mesh with the pinion. Rock ring to allow the teeth of the gears to mesh. With pressure still applied to the differential case, set indicator at "0".

(11) Press the differential case (ring gear) away from the pinion gear to obtain an indicator reading. Repeat until the same reading is obtained each time. This reading will represent the necessary amount of shims required between the differential case and differential bearing on the ring gear side. Remove indicator and differential case from the carrier. Remove differential from case, remove master bearings.

(12) Assemble the required amount of shims onto hub (ring gear side) as determined. Place bearing cone on hub of ease. Use bearing installer Tool C-4025A and Handle C-4171, seat bearing cone (Fig. 41).

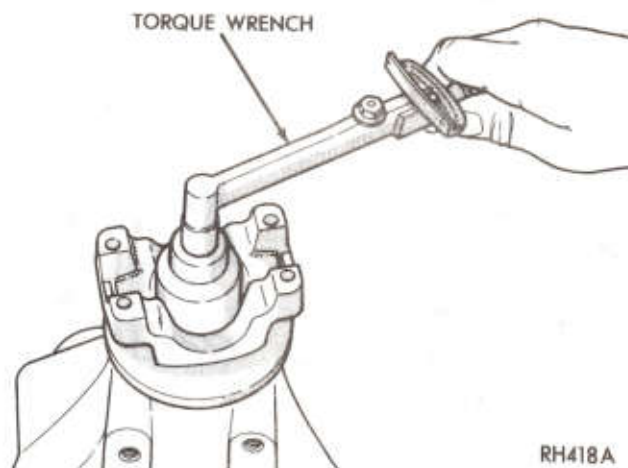


Fig. 38—Rotating Pinion to Seat Bearings

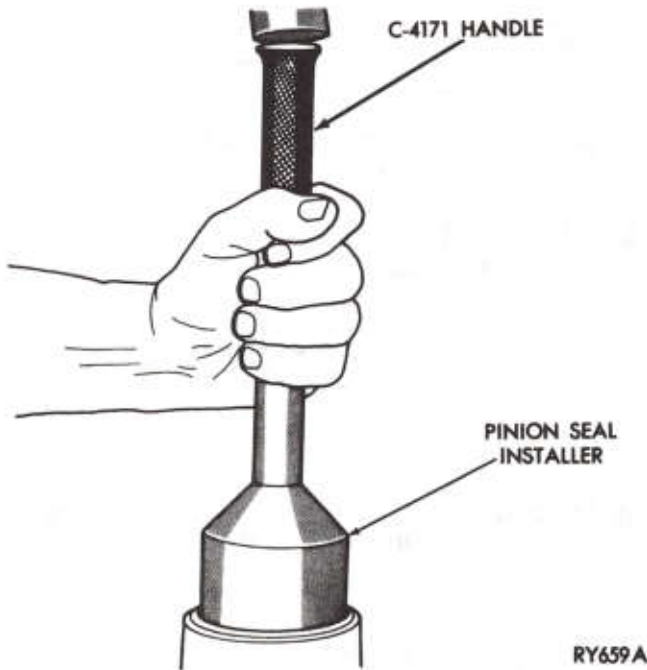


Fig. 39—Installing Pinion Seal

(13) Assemble the remaining of the total shim pack which was determined in step 7, assembly and installation, on the opposite side of the differential case. Add an additional .015" (.38mm) of shims on this side to compensate for differential bearing preload. Assemble differential bearing using Tool C-4025-A and C-4171.

(14) Install spreader and indicator to carrier and

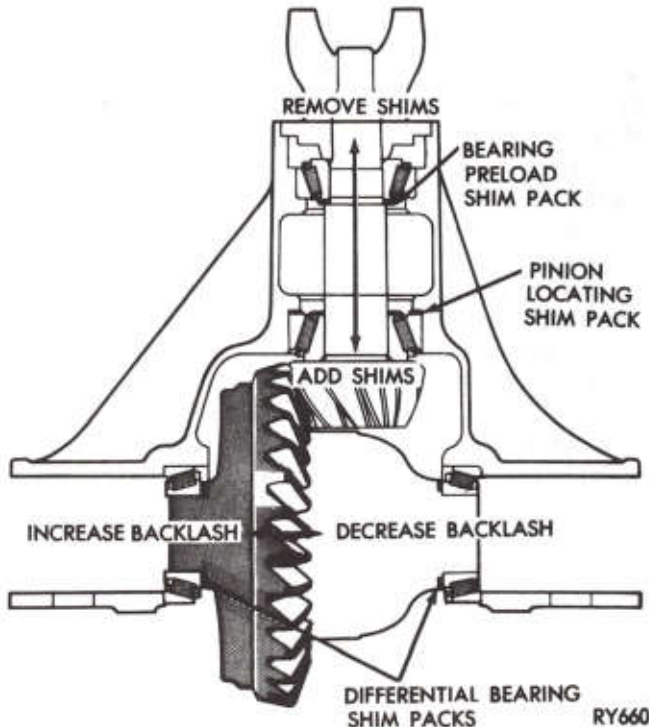


Fig. 40—Use of Shims to Adjust Gear Tooth Contact

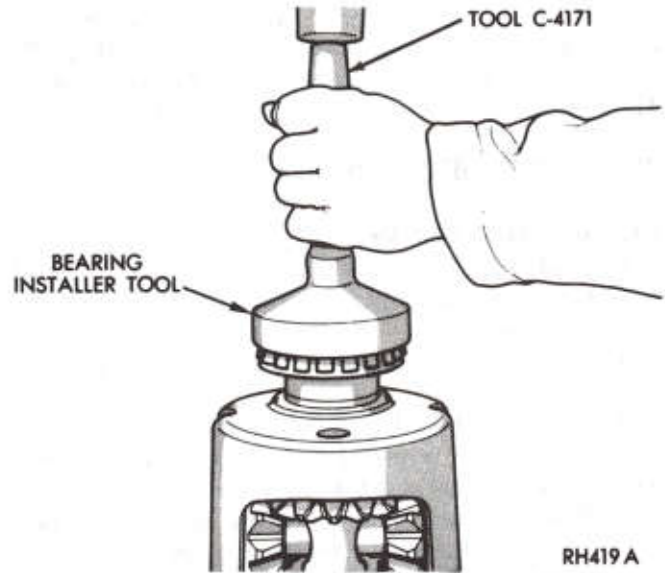


Fig. 41—Seating Bearing Cone

spread housing.

Do not spread over .020 (.51mm). Remove indicator.

(15) Assemble differential bearing cups to differential bearing cones.

Install differential assembly into carrier.

(16) Install bearing caps. Make sure the letters stamped on the caps correspond with those on the carriers. Tighten bearing cap screws to 80-90 ft. lbs. (108-122 N-m). (Fig. 42).

(17) Check ring gear and pinion backlash in three equally spaced points with dial indicator as shown in (Fig. 45).

Backlash tolerance is .004" to .009" (10-23mm) and cannot vary more than .002" (.05mm) between points checked.

High backlash is corrected by moving the ring gear closer to the pinion.

Low backlash is corrected by moving ring gear away from the pinion.

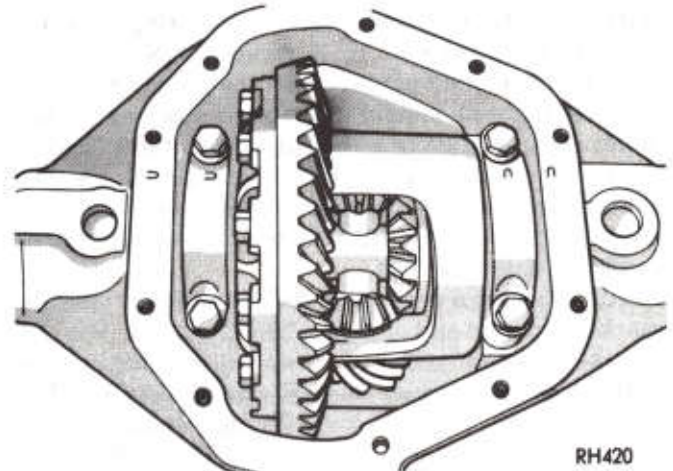


Fig. 42—Differential Installed in Carrier

These corrections are made by switching shims from one side of the differential case to the other. (Fig. 40).

(18) Install new cover gasket and install cover plate. Tighten screws to 30-40 ft. lbs. (41-54 N·m).

DRIVE PINION DEPTH OF MESH

(Using Tool C-758-D6)

Axle setting gauge Tool C-785-D6 is used to install drive pinion bearing cups as well as to determine pinion depth of mesh.

(1) Start both drive pinion bearing cups into axle housing.

(2) Assemble Tool C-785-D6 by positioning spacer SP-5184 on main screw of tool. Position rear pinion bearing cone on tool screw and insert into axle housing.

(3) Position front pinion bearing cone over main screw of tool followed by compression sleeve SP-535-A, centralizing washer SP-534, and main screw nut SP-533.

(4) Lubricate drive pinion bearing cone with axle lubricant.

(5) To install pinion bearing cups, hold compression sleeve from turning with Tool C-3281, tighten nut, thereby drawing pinion bearing cups into axle housing bearing cup bores. Permit tool to turn several revolutions during tightening operation to permit bearing rollers to align and prevent brinnelling of bearing cups.

Do not remove tool after installing cups. Pinion depth of mesh will be determined next.

(6) With main tool left in axle housing after installing drive pinion bearing cups, loosen tool nut and retighten nut to produce 10-30 in. lbs. (1-3 N·m) of preload. Rotate while tightening to align bearing rollers.

(7) Install gauge block SP-5260 on main tool and tighten screw with an allen wrench securely.

(8) Position cross bore arbor SP-5183 in axle housing in differential bearing seats. Center the arbor so that an approximate equal distance is maintained at both ends. Correctly position differential bearing caps and insert bolts and tighten to 10 ft. lbs. (14 N·m).

(9) Using a feeler gauge, select the proper thickness of shims that will snugly fit between arbor and gauge block. This fit must be snug but not too tight (similar to the pull of a feeler gauge). This measurement is then used in determining the correct thickness shim pack for installation behind the rear pinion bearing cup and carrier casting (Fig. 43).

(10) To select a shim pack for installation, read the markings on the end of pinion head (-0, -1, -2, +1, +2, etc.). When marking is - (minus), add that amount to the thickness of shim pack selected in step (9). When the marking is + (plus), subtract that amount. Treat other pinion markings in a similar manner. Shims are available in .003, .005, and .010 inch (.076, .127 and .254mm) thickness. See, "Pinion Setting Chart".

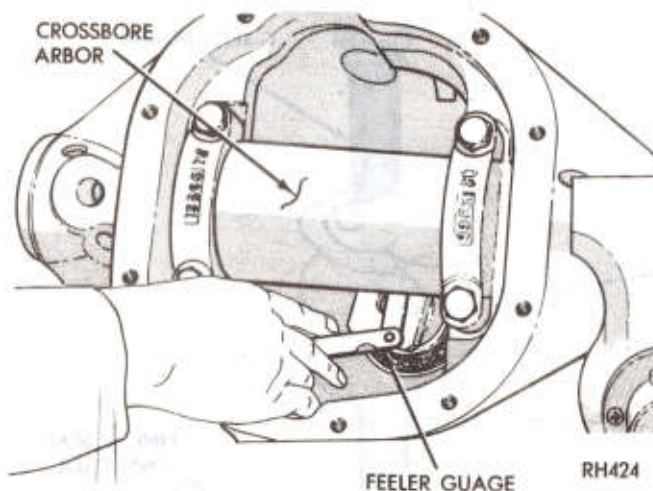


Fig. 43—Determining Shim Pack Thickness for Drive Pinion Depth of Mesh

(11) Remove tool arbor and tool from axle housing.

(12) Using a brass drift or soft punch and hammer, remove rear pinion bearing cup from casting.

(13) Position the correct shim pack in axle housing cup bore and install rear bearing cup as described previously in steps (1) thru (5). When cup is properly seated, remove tool and pinion bearing cones.

PINION BEARING PRELOAD

(1) Lubricate rear drive pinion bearing cone with axle lubricant and install bearing cone on pinion stem using Tool C-3095-A. An arbor press may be used in conjunction with tool.

(2) Install drive pinion and bearing assembly in carrier and install the original front pinion bearing shim pack followed by the bearing cone. **Do not install oil seal at this time.**

(3) Install universal joint flange, washer and nut. Tighten nut 250-270 ft. lbs. (339-366 N·m). Rotate pinion several complete revolutions to seat bearing rollers.

(4) Using an inch-pound torque wrench Tool C-685-A, measure pinion bearing preload by rotating pinion with handle of wrench floating (Fig. 44). Take reading while handle is moving through several complete revolutions. Accurate reading can be made only with nose of axle in upright position. Correct preload is 10-20 in. lbs. (1-2 N·m). **Add** shim to decrease preload and **Subtract** shims to increase preload. Shims are available in the following thicknesses: .003, .005, .010, and .030 inch (.076, .127, .254, and .762mm).

(5) After the correct pinion bearing preload has been established, remove the universal joint flange, nut, and washer.

(6) Install oil slinger and gasket. Using pinion seal installing Tool C-3719 and C-4171 Handle, install drive pinion oil seal.

(7) Install universal joint flange, washer, and nut. Tighten nut 250-270 ft. lbs. (339-366 N·m).

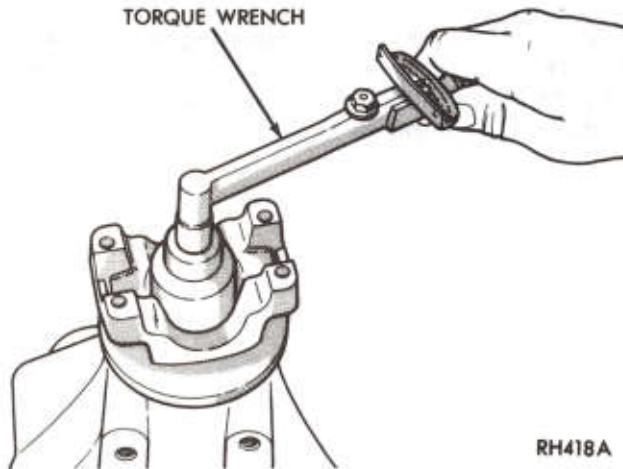


Fig. 44—Checking Pinion Bearing Preload

DIFFERENTIAL BEARING PRELOAD AND DRIVE GEAR AND PINION BACKLASH

(1) With drive pinion and bearings installed and bearing preload set, install differential case and ring gear assembly with their respective bearing cups. Install bearing caps in their positions, align identification marks and tighten cap bolts finger tight.

Refer to the measurement taken previously in step (7) of "Differential—Installation."

This reading taken before drive pinion was installed represents the total clearance between differential bearing cups and carrier casting. Perform the following steps to determine thickness of shims required behind each bearing cone to take up the clearance and establish correct bearing preload and backlash.

(2) Install a dial indicator and position the contact point against back face of ring gear. Move the differential and ring gear assembly tight against the drive pinion, set the dial indicator on 0. Move the differential and ring gear assembly in the opposite direction as far away from pinion as possible and note the reading on dial indicator.

This reading represents the thickness of shim pack necessary to take up the clearance between the bearing cup and the case on the ring gear side of the differential assembly. Subtract this reading from the previously recorded total reading to obtain the amount of shims necessary to take up the clearance between the bearing cup and the case at the pinion side of the differential.

(3) Remove differential and ring gear assembly from carrier.

(4) Remove differential bearing cones. Install the correct thickness shim pack determined in step (2) between bearing cone and differential case hub shoulder using Tool C-4025 and C-4171 handle. Add an additional .015 inch shim to the drive gear tooth side of differential and install the differential bearing cones. This additional .015 inch shim pack provides the correct bearing preload and backlash.

(5) Position spreader Tool W-129-A in locating holes of carrier and tighten screw finger tight. Install dial indicator and spread carrier .015 to .020 inch (.381 to .508mm). Do not exceed this limit to permit placing of differential and ring gear assembly in carrier.

(6) Install the bearing caps in their respective positions as indicated by identification marks on caps and carrier. Remove the spreader tool. Coat the bearing cap bolt threads with sealing compound and install and tighten bolts snugly.

(7) Tap the drive gear lightly with a rawhide hammer to properly seat the differential bearing and cups. **Care must be taken in this operation to prevent nicking the teeth of ring gear or drive pinion as they are meshed together.** Tighten the bearing cap bolts to 70-90 ft. lbs. (95-122 N·m).

(8) Attach a dial indicator to carrier and with indicator contact point contacting ring gear tooth (Fig. 45), measure the backlash between the ring gear and drive pinion.

(9) Check backlash at four equally spaced points around circumference of ring gear. Backlash must be held between .004-.009 inch (.101-.229mm) and cannot vary more than .002 inch (.050mm) between the four positions checked.

If backlash does not fall within these specifications, change shim pack thickness on both differential bearing hubs to maintain proper bearing preload and backlash.

GEAR TOOTH CONTACT PATTERN

Gear tooth contact will be correct if all preceding procedures have been followed.

LUBRICATION

When vehicle is serviced for other reasons check for evidence of gear oil leakage. If leakage is evident check

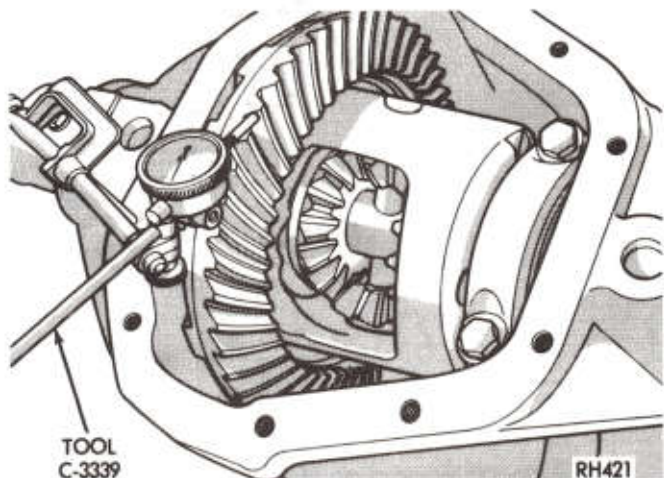


Fig. 45—Checking Backlash Between Drive Gear and Pinion

the fluid level in the axle through the filler plug hole. When checking the level, be sure the vehicle is in a level position on an axle or drive on type hoist. Maintain fluid level to bottom of filler plug hole.

In these Differentials, use only the MOPAR Hypoid

Lubricant Part Number 4318058 or equivalent.

Should the axle become submerged in water, the lubricant must be changed immediately to avoid the possibility of early axle failure resulting from contamination of the lubricant by water.

SPECIFICATIONS

FRONT SUSPENSION

Front Drive Axle Alignment (Standard Equipment)	W150 W250 W350 131" W.B. and 149" W.B.	(Extra Equip. W250) W350 135" W.B. and 149" W.B.
Make	Spicer	Spicer
Type	Hypoid	Hypoid
Model	44-8FD	60
Differential Lubrication Capacity (Pts.)	3 (1.4L)	6 (2.8L)
(Imp. Meas.)	2.5 (1.1L)	5 (2.3L)
Axle Capacity (Lbs.)	3500 (1586kg) 4000 (1812kg) with Snow-Plow Package	4500 (2039kg)
	Acceptable Alignment Range	Preferred Setting
Camber	+1/2° to 1-1/2°	+1°
*Caster	+1/2° to 3-1/2°	+2°
King Pin Inclination	8.5°	8.5°
Toe-In (At Hub Height)	-0.05° to +0.45°	.20°

Independent Front Suspension Alignment (Standard Equipment)	AD150	
	D150	
	D250	
	D350	
Make	Chrysler	
Type	3000 (AD) 3300 (D150, D250)	
Capacity (Lbs.)	4000 (D350, Ex. Eqt. D250)	
	Acceptable Alignment Range	Preferred Setting
Camber	0 to 1°	+1/2°
*Caster	- 1° to + 2°	+1/2°
Toe-in (at Hub Height)	.0 to .50°	.25°
Turning Angle (Base Tire) Left & Right	33° 33°	

*If vehicle wanders caster should be increased. If steering effort is very high, especially when cornering, caster should be decreased.

TIGHTENING REFERENCE

Location	Foot Pounds	Inch Pounds	Newton meters
AXLE HOUSING COVER			
44-8FD	20		27
BALL JOINT NUTS			
Lower AD150, D150 and D250	135		183
D350	175		237
Upper D150 and D250	135		183
D350	175		237
BRAKE SUPPORT TO STEERING KNUCKLE			
AD150, D150 and D250	215		291
D350	225		305
COMPANION FLANGE NUT			
44-8FD	210		285
DIFFERENTIAL CARRIER CAP			
44-8FD	80		108
LOWER CONTROL ARM MOUNTING			
AD150, D150, D250 and D350	210		285
PROP SHAFT CLAMPING SCREWS			
AW150, W150 and W250		170	19
W350		300	34
AD150, D150, D250, D350		170	19
SHOCK ABSORBER LOWER MOUNTING			
AD150, D150, D250, D350		200	23
AW150, W150 and W250 with 44FBJ axle	55		75
W250 and W350 with 60 Axle	55		75
SHOCK ABSORBER UPPER MOUNTING			
AD150, D150, D250 and D350	25		34
AW150, W150 and W250 with 44FBJ axle	55		75
W250 and W350 with 60 Axle	55		75
SPRING CLIP "U" BOLTS			
AW150, W150 and W250 with 44FBJ axle	110		149
W250 and W350 with 60 Axle	110		149
STEERING LINKS			
AD150, D150 and D250	47		64
D350	55		75
AW150, W150, W250, W350	60		81
STRUT FRONT MOUNTING			
AD150, D150, D250, D350	50		68
STRUT REAR MOUNTING			
AD150, D150, D250, D350	85		115
TIE ROD CLAMPING BOLT			
AD150, D150 and D250		160	18
D350	25		34
TIE ROD END NUTS			
AD150, D150, D250, D350	40		54
AW150, W150, W250, W350	60		81
SWAY BAR (If So Equipped)			
AD150, D150, D250, D350			
Frame End		270	31
Link End		100	11
UPPER CONTROL ARM MOUNTING (Cam Bolt)			
D150, D250, D350	70		95

REAR AXLE

CONTENTS

	Page		Page
REAR AXLE ALIGNMENT CHECKING		REAR AXLE NOISE DIAGNOSIS	3
PROCEDURE	5	SERVICE DIAGNOSIS	1
REAR AXLE ASSEMBLY (8-3/8 IN. and 9-1/4 IN.)		SPECIFICATIONS	40
RING GEAR	6	SURE-GRIP DIFFERENTIAL	22
REAR AXLE ASSEMBLY SPICER (ALL)	24	TIGHTENING REFERENCE	41
REAR AXLE ASSEMBLY SPICER 60			
(TRAC-LOK DIFFERENTIAL)	38		

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
REAR WHEEL NOISE	(a) Wheel loose. (b) Faulty, brinelled wheel bearing.	(a) Tighten loose nuts. (b) Faulty or brinelled bearings must be replaced.
REAR AXLE DRIVE SHAFT NOISE	(a) Misaligned axle housing. (b) Bent or sprung axle shaft. (c) End play in drive pinion bearings. (d) Excessive gear lash between ring gear and pinion. (e) Improper adjustment of drive pinion shaft bearings. (f) Loose drive pinion companion flange nut. (g) Improper wheel bearing adjustment. (h) Scuffed gear tooth contact surfaces.	(a) Inspect rear axle housing, alignment. Correct as necessary. (b) Replace bent or sprung axle shaft. (c) Refer to Pinion Bearing Pre-Load. (d) Check adjustment of ring gear and pinion. Correct as necessary. (e) Adjust pinion bearings. (f) Tighten drive pinion flange nut to torque specified under, "Tightening References." (g) Readjust as necessary. (h) If necessary, replace scuffed gears.
REAR AXLE DRIVE SHAFT BREAKAGE	(a) Misaligned axle housing. (b) Vehicle overloaded. (c) Abnormal clutch operation. (d) Grabbing clutch.	(a) Replace broken shaft after correcting rear axle housing alignment. (b) Replace broken shaft. Avoid excessive weight on vehicle. (c) Replace broken shaft, after checking for other possible causes. Avoid erratic use of clutch. (d) Replace broken shaft. Inspect clutch and make necessary repairs or adjustments.
DIFFERENTIAL CASE BREAKAGE	(a) Improper adjustment of differential bearings. (b) Excessive ring gear clearance. (c) Vehicle overloaded. (d) Erratic clutch operation.	(a) Replace broken case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings. (b) Replace broken case; examine gears and bearings for possible damage. At reassembly, adjust ring gear and pinion backlash. (c) Replace broken case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle. (d) Replace broken case. After checking for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.

Condition	Possible Cause	Correction
SCORING OF DIFFERENTIAL GEARS	(a) Insufficient lubrication.	(a) Replace scored gears. Scoring marks on the pressure face of gear teeth or in the bore are caused by instantaneous fusing of the mating surfaces. Scored gears should be replaced. Fill rear axle to required capacity with proper lubricant. See Specification section.
	(b) Improper grade of lubricant.	(b) Replace scored gears. Inspect all gears and bearings for possible damage. Clean out and refill axle to required capacity with proper lubricant. See Lubrication section.
	(c) Excessive spinning of one wheel.	(c) Replace scored gears. Inspect all gears, pinion bores and shaft for scoring, or bearings for possible damage. Service as necessary.
TOOTH BREAKAGE (RING GEAR AND PINION)	(a) Overloading.	(a) Replace gears. Examine other gears and bearings for possible damage. Replace parts as needed. Avoid overloading of vehicle.
	(b) Erratic clutch operation.	(b) Replace gears, and examine remaining parts for possible damage. Avoid erratic clutch operation.
	(c) Ice-spotted pavements.	(c) Replace gears. Examine remaining parts for possible damage. Replace parts as required.
	(d) Improper adjustment.	(d) Replace gears. Examine other parts for possible damage. Make sure ring gear and pinion backlash is correct.
REAR AXLE NOISE	(a) Insufficient lubricant.	(a) Refill rear axle with correct amount of the proper lubricant. See Lubrication section. Also check for leaks and correct as necessary.
	(b) Improper ring gear and pinion adjustment.	(b) Check ring gear and pinion tooth contact.
	(c) Unmatched ring gear and pinion.	(c) Remove unmatched ring gear and pinion. Replace with a new matched gear and pinion set.
	(d) Worn teeth on ring gear or pinion.	(d) Check teeth on ring gear and pinion for contact. If necessary, replace with new matched set.
	(e) Loose drive pinion bearings.	(e) Adjust drive pinion bearings.
	(f) Loose differential gear bearings.	(f) Adjust differential gear bearings.
	(g) Misaligned or sprung ring gear.	(g) Check ring gear for runout.
	(h) Loose carrier cap screws.	(h) Tighten to specifications.
LOSS OF LUBRICANT	(a) Lubricant level too high.	(a) Drain excess lubricant by removing filler plug and allow lubricant to level at lower edge of filler plug hole.
	(b) Worn axle shaft oil seals.	(b) Replace worn oil seals with new ones. Prepare new seals before replacement.
	(c) Cracked rear axle housing.	(c) Repair or replace housing as required.
	(d) Worn drive pinion oil seal.	(d) Replace worn drive pinion oil seal with a new one.
	(e) Scored and worn companion flange.	(e) Replace worn or scored companion flange and oil seal.
	(f) Axle cover not properly sealed.	(f) Remove cover and clean flange and reseal.

Condition	Possible Cause	Correction
OVERHEATING OF UNIT	(a) Lubricant level too low.	(a) Refill rear axle.
	(b) Incorrect grade of lubricant.	(b) Drain, flush and refill rear axle with correct amount of the proper lubricant. See Lubrication Section.
	(c) Bearings adjusted too tightly.	(c) Readjust bearings.
	(d) Excessive wear in gears.	(d) Check gears for excessive wear or scoring. Replace as necessary.
	(e) Insufficient ring gear to pinion clearance.	(e) Readjust ring gear and pinion backlash and check gears for possible scoring.

REAR AXLE NOISE DIAGNOSIS

Most rear axle failures are relatively simple to locate and correct, although rear axle noise is a little more difficult to diagnose and make the necessary repairs. The most essential part of rear axle service is proper diagnosis of the problem.

All rear axles are noisy to a certain degree. Axles can be noisy if they are not properly adjusted or lack lubrication. Usually when new improperly set gears are noisy, the disturbing noise can be "adjusted out".

If the axle noise complaint is made within the first 1500 miles (2413km) and the gears are not scored due to lack of lubrication, the gear adjustment should be checked and corrected if necessary. Poor tooth pattern, incorrect drive gear backlash and a loose pinion nut are the primary causes of gear noise in new axles. Regardless of what you've heard to the contrary, noisy gears will not get quieter with added mileage...they will stay the same or get worse.

Slight axle noise heard only at certain speeds or under remote conditions must be considered normal. Axle noise tends to "peak" at varying speeds and the noise is **NOT ALWAYS** indicative of trouble in the axle.

If noise is present in an objectionable form, loud or at all speeds, an effort should be made to isolate the noise as being in one particular unit of the vehicle. Many noises, reported as coming from the rear axle actually originate from other sources such as tires, road surfaces, wheel bearings, engine, transmission, exhaust, propeller shaft vibration, universal joint noise or body drumming. A thorough and careful check should be made to determine the source of the noise before any disassembly and teardown of the rear axle is attempted.

Axle noises normally fall into two categories; gear noise and bearing noise. The complete isolation of noise in any one unit requires considerable skill and previous experience. Eliminating certain type noises often baffle even the most experienced personnel. Often such practices as raising tire pressures to eliminate tire noise, listening for the noise at varying speeds under different load conditions such as; drive, float and coast, and under certain highway conditions,

swerving from left to right to detect wheel bearing noise, will aid even the beginner in detecting axle shaft bearing noise in axles that use the tapered roller bearing axle shaft.

To make a good diagnostic check for rear axle noise **a thorough road test is necessary**. Select a level smooth blacktop road. This will reduce tire noise and body drumming. Drive far enough to thoroughly warm up the axle to normal operating temperature.

Drive and note speed at which noise occurs. Then stop and, with clutch disengaged or automatic transmission in neutral, run engine slowly up and down through engine speeds, corresponding to speed at which noise was most pronounced, to determine if it is caused by exhaust roar, or other engine conditions. Repeat, while engaging and disengaging clutch (transmission in neutral), to determine if noise can only be isolated by removing propeller shaft and operating transmission in high.

Tire Noise

Tire noise is often mistaken for rear axle noise even though the noisy tires may be located on the front wheels. Tires that are unbalanced or worn unevenly or have surfaces of non-skid type design, or worn in a saw tooth fashion are usually noisy and often produce noises that seem to originate in the rear axle.

Tire noise changes with different road surfaces, but rear axle noise does not. Inflate all tires to approximately 20 pounds (138 kPa) over specified pressure (for test purposes only.) This will materially alter noise caused by tires, but will not effect noise caused by rear axle. Rear axle noise usually ceases when coasting at speeds under 30 mph (48 km/h); however, tire noise continues, but with lower tone, as speed is reduced. Rear axle noise usually changes when comparing drive and coast, but tire noise remains about the same.

Distinguish between tire noise and differential noise by noting if noise varies with various speeds or sudden acceleration and deceleration; exhaust and axle noise show variations under these conditions while tire noise remains constant and is more pronounced at speeds of 29 to 30 mph (32 to 48 km/h). Further check for tire noise by driving over smooth

pavements or dirt roads (not gravel) with tires at normal pressure. If noise is caused by tires, it will noticeably change or disappear and reappear with changes in road surface.

Front Wheel Bearing Noise

Loose or rough front wheel bearings will cause noise which may be confused with rear axle noises; however, front wheel bearing noise does not change when comparing drive and coast. Light application of brake while holding speed steady will often cause wheel bearing noise to diminish, as this takes some weight off the bearing. Front wheel bearings may be easily checked for noise by jacking up the wheels and spinning them, also by shaking wheels to determine if bearings are loose.

Rear suspension rubber bushings and spring insulators help to dampen out rear axle noise when properly and correctly installed. Check to see that no metallic interference exists between the springs and spring hangers, shackles or U-bolts. Metal to metal contact at those points may result in telegraphing road noise and normal axle noise which would not be objectionable if properly installed and tightened to specifications.

Gear Noise

Abnormal gear noise can be recognized easily because it produces a cycling tone and will be very pronounced through the speed range in which it occurs. Gear noise may be developed under one or more of the following conditions, "drive", "road load", "float" or "coast". Gear noise usually tends to peak in a narrow speed range or ranges. Gear noise is more prominent between 30 and 40 mph (48 to 64 km/h) and 50 to 60 mph (80-96 km/h). Abnormal gear noise is quite rare and if present it usually originates from scoring of the ring and drive pinion gear as a result of insufficient or improper lubrication of the axle assembly. The differential side gears and pinions very seldom cause trouble as they are only under loads when the rear wheels travel at different speeds; such as when turning corners.

When objectionable axle noise is heard, note the driving conditions and speed range.

Perform a tooth contact pattern check on 8-3/8" and 9-1/4" (212.72 and 234.95 mm) ring gear to determine if the best possible pattern has been obtained. If pattern is found to be unacceptable, reshim and adjust to obtain the best possible tooth pattern. If after readjustment noise still persists, replace with new gear set.

Pre-Disassembly Investigation

A close examination of the rear axle assembly prior to disassembly can often reveal valuable information as to the extent and type of repairs or adjustments

necessary. This information coupled with the road test results will provide a basis for determining the degree of disassembly required. Since the most frequent causes of axle noise are improper backlash or differential bearing preload, or both a few simple adjustments may be all that is necessary to correct the complaint.

Therefore, before disassembly the following checks should be made; drive gear and pinion backlash, pinion bearing preload, and these results recorded and analyzed. It is felt that these measurements and their results will aid you in making the necessary repairs to the axle assembly.

Bearing Noise (Drive Pinion and Differential)

Defective or damaged bearings generally produce a rough growl or grating sound, that is constant in pitch and varies with the speed of the vehicle. This fact will allow you to diagnose between bearing noise and gear noise.

Drive pinion bearing noise resulting from defective or damaged bearings can usually be identified by a constant rough sound. Front pinion bearing noise is usually most pronounced on "coast", whereby rear pinion bearing is loudest on "drive". Pinion bearings are rotating at a higher rate of speed than the differential side bearings or the axle shaft bearings. These particular noises can be picked up best by road testing the vehicle in question on a smooth road (black top). However, extreme caution should be taken not to confuse tire noise with bearing or gear noise. If doubt should exist tire treads should be examined for irregularities that will often produce such noise.

Differential bearing noise will usually produce a constant rough tone which is much slower than the noise caused by the pinion bearings.

Rear Wheel Bearing Noise

Defective or damaged rear wheel bearings produce a vibration or growl which continues with vehicle coasting and transmission in neutral. A brinnel rear wheel bearing causes a whirring noise. Spalled rear wheel bearings normally produce a noise similar to a growl, created from either flaked or pitted rollers or bearings races. Unless the damage is severe, rear axle bearing noise is seldom heard above 30 mph (48 km/h).

To differentiate between wheel bearings and gear noise, road test the vehicle on a smooth road (black-top) at medium and low speed. With traffic permitting, swerve the vehicle sharply right to left. If the noise in question is caused by wheel bearings, it will usually increase when the vehicle is swerved and will probably be coming from the bearing on the loaded side. (tapered roller bearing axle shaft only).

If the noise in question cannot be isolated an inspection of bearings will be necessary.

Knock at Low Speeds

Low speed knock is usually caused by brinelled universal joints or differential side gear hub to counterbore clearance being too great. Inspect and replace universal joint or differential case and side gear as required.

Drive-Line Snap

A snap or a sudden start, either forward or reverse, may be caused by a loose companion flange. Remove the propeller shaft, flange and reinstall 180 degrees from original position. Pinion bearing preload and pinion nut torque must be reset to original settings upon reinstallation.

Backlash Clunk

Excessive clunk on acceleration and deceleration can be caused by any one of the following items or a combination; (excessive clearance between) (1) Differential pinion shaft to differential case, (2) Axle shaft to differential side gear splines, (3) Differential side gear hub to differential case counterbore, (4) Differential side gear to pinion, (5) Worn thrust washers, (6) Drive gear backlash. Measure and inspect components and replace as required and/or adjust to proper specifications.

Engine and Transmission Noise

Sometimes noises which seem to originate in the rear axle are actually that of the engine or transmission. To diagnose which unit is actually causing the noise, observe the approximate vehicle speed and conditions under which the noise is most pronounced; stop the vehicle in a quiet place to avoid any interfering noises. With engine running and transmission in neutral, run engine slowly up and down through engine speeds corresponding to approximate speed at which the noise was most pronounced. If a noise similar is produced in this manner it usually can be assumed that the noise was caused by the engine or transmission and not that of the rear axle.

Propeller Shaft Vibration

Objectional vibrations, while operating on "good" surface roads, may be caused by tires, power plant or prop shafts.

An orderly method of eliminating the vibration source will aid in a speedy and correct diagnosis. The order of analysis should be:

- (a) Tires
- (b) Power Plant
- (c) Prop Shaft

Tires which are out of round or contain excessive unbalance will be of a lower frequency such that mirror and door shake will be prominent. Tire disturbances will require correction before proceeding.

Power Plant disturbances can be found by operating the engine (transmission in neutral) through the

speed range and noting any vibration which occurs.

Prop Shaft vibration will increase in intensity as vehicle speed is increased, and is not sensitive to torque. A vibration period which is evident between two speeds (such as 55 to 65 mph (88 to 105 km/h) and not evident above the range is not due to prop shaft unbalance. Bad universal joints or unsatisfactory angles may be the cause of a vibration range.

Rear Axle Alignment Checking Procedure

The following describes the procedure for checking rear axle alignment to determine if a complaint of abnormal rear tire wear is the result of a "bent" rear axle housing:

(1) Raise both rear wheels off the ground using a frame contact hoist.

(2) Place a one inch long piece of masking tape in the center of each tire tread for use as "reference marks".

(3) With both "reference marks" pointing to front of vehicle, measure the distance between the outside edges of the two pieces of tape. Record this measurement as the "front of tire" (FTR) reading.

(4) Rotate the rear wheels so that the "reference marks" of each rear wheel now point to the rear of vehicle. Measure the distance between the outside edges of the two pieces of tape and record the measurements as the "rear of tire" (RTR) reading.

(5) Subtract the "rear of tire" measurement from the "front of tire" measurement to obtain the "toe out" condition of the axle being checked. **The specification is 1/16 inch (1.6 mm) toe-in to 3/16 inch (4.8 mm) toe-out.**

(6) Rotate both rear wheels so that the "reference marks" are pointing down. Measure the distance between the outside of the two pieces of tape and record this measurement as "bottom of tire" (BTR) reading.

(7) Average the sum of the "front of tire" reading (FTR) and the "rear of tire" reading (RTR), then from this average figure subtract "bottom of tire" reading (BTR) to obtain the camber. **The specification is— 1/16 inch to 3/32 inch (1.6 to 2.4 mm) camber.**

$$\frac{FTR + RTR}{2} - BTR = \pm \text{CAMBER}$$

If BTR is smaller than the average figure, the camber reading is positive +. If the BTR is larger than the average figure, the camber reading is negative (-).

Tire Wheel Balance

Off the vehicle balancing is the preferred method. If the vehicle is equipped with dual rear wheels, it is an absolute must that the wheel and tire assemblies be removed from the vehicle when balancing is necessary.

Balancing tires on the vehicle essentially balances

the tire, wheel and brake drum. This balance condition is lost when tires are rotated to equalize tire tread wear, or when tires are removed for any reason and not reinstalled in the same position and indexed on the studs exactly as before removal. However, where on-the-vehicle rear tire balance is attempted, both front wheels **must** be securely blocked to prevent any vehicle movement. On vehicles of standard type differential (not equipped with Sure-Grip), only the rear wheel being balanced should be off the ground. **When attempting rear tire balance of this type with ONE rear wheel off the ground, a 35 mph (56 km/h) speedometer reading will indicate a 70 mph (113 km/h) rear wheel speed. The 35 mph (56 km/h) speedometer reading is the maximum necessary for dynamic tire balance.**

CAUTION: Do not exceed a 35 mph (56 km/h) speedometer reading with conventional differentials.

With no load on the engine, it is possible to attain tire rotational speeds sufficient to cause violent tire failure and create a hazardous situation.

When on-the-vehicle rear tire balance is attempted with vehicles of Sure-Grip type differential, elevate

both rear wheels and remove wheel not being balanced.

Replace wheel nuts and tighten securely. Both front wheels **must** be securely blocked to prevent any vehicle movement. **When attempting rear tire balance of this type with both rear wheels off the ground, a 35 mph (56 km/h) speedometer reading will indicate a 35 mph (56 km/h) speedometer rear wheel speed. A 70 mph (113 km/h) speedometer reading is the maximum necessary for dynamic tire balance. When said wheel is satisfactorily balanced, replace the unbalanced wheel and balance it in the same manner. It is not necessary to remove the balanced wheel.**

CAUTION: Do not exceed a 70 mph (113 km/h) for Sure-Grip type differentials.

With no load on the engine, it is possible to attain tire rotation speeds sufficient to cause violent tire failure and create a hazardous situation.

For additional information refer to the instructions supplied by manufacturer of balancing equipment being used.

REAR AXLE ASSEMBLY 8-3/8 IN. AND 9-1/4 IN. RING GEAR

INDEX

	Page		Page
Axle Shafts and Bearings	9	General Information	6
Assembly and Installation	9	Lubrication	21
Removal and Disassembly	9	Rear Axle Assembly	11
Differential Bearing Preload and		Installation	11
Drive Gear Backlash	18	Removal	11
Differential Reconditioning	11	Removal and Replacement of Drive Pinion	
Assembly and Installation	14	Flange and Oil Seal in Vehicle	21
Cleaning and Inspection	14	Service Diagnosis	1
Removal and Disassembly	11	Service Procedures	9
Differential Side Gear Clearance Checking		Specifications	40
and Adjustment	19	Tightening Reference	41
Gear Tooth Contact Pattern	19		

GENERAL INFORMATION

CAUTION: Anytime rear axle servicing is necessary, or axle is being rotated through use of the engine or other means, ELEVATE BOTH REAR WHEELS.

This rear axle assemblies shown in figures 1 and 2 are of the integral carrier housing hypoid gear type in which the centerline of the drive pinion is mounted below the centerline of the ring gear.

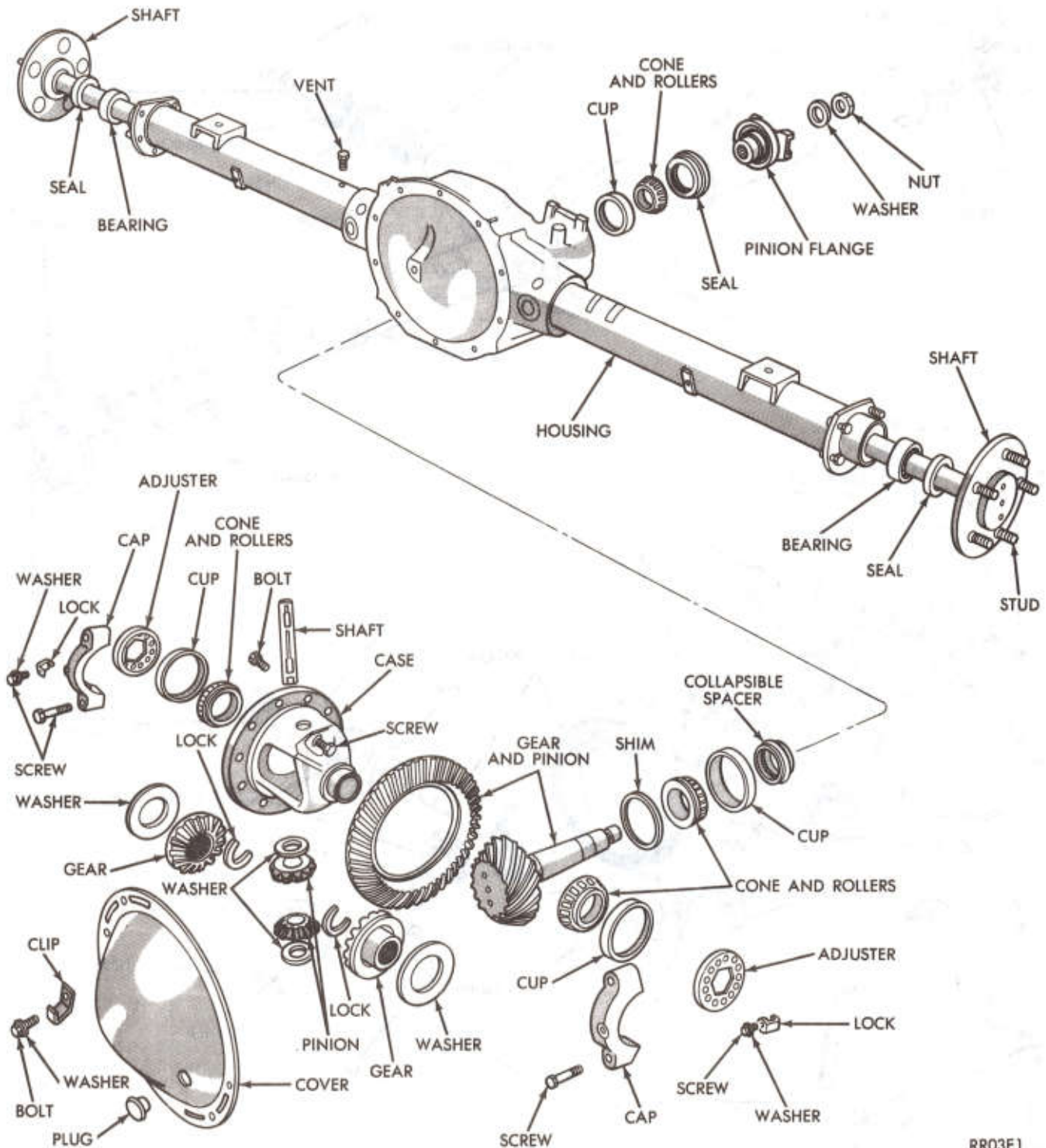
The rear axle housing is an iron casting with tubular legs pressed into and welded to the carrier to form a complete carrier and tube assembly. A removable stamped steel cover bolted to the rear of the carrier, permits inspection and service of the differential without removing the complete rear axle from the vehicle.

A stamped small metal tag is attached beneath one

of the cover screws to identify the axle ratio.

The drive pinion is supported by two preloaded taper roller bearings. The front and rear pinion bearing cones are a press-fit on the pinion stem. The front and rear pinion bearing cups are a press-fit against a shoulder that is recessed in carrier casting. The drive pinion depth of mesh adjustment is controlled by the use of metal shims which are installed between the rear drive pinion bearing cone and the drive pinion head.

Drive pinion bearing preload is obtained by means of a metal collapsible spacer positioned between the front and rear pinion bearing cones. The spacer is compressed to provide the necessary required pinion bearing preload by tightening the pinion flange nut.



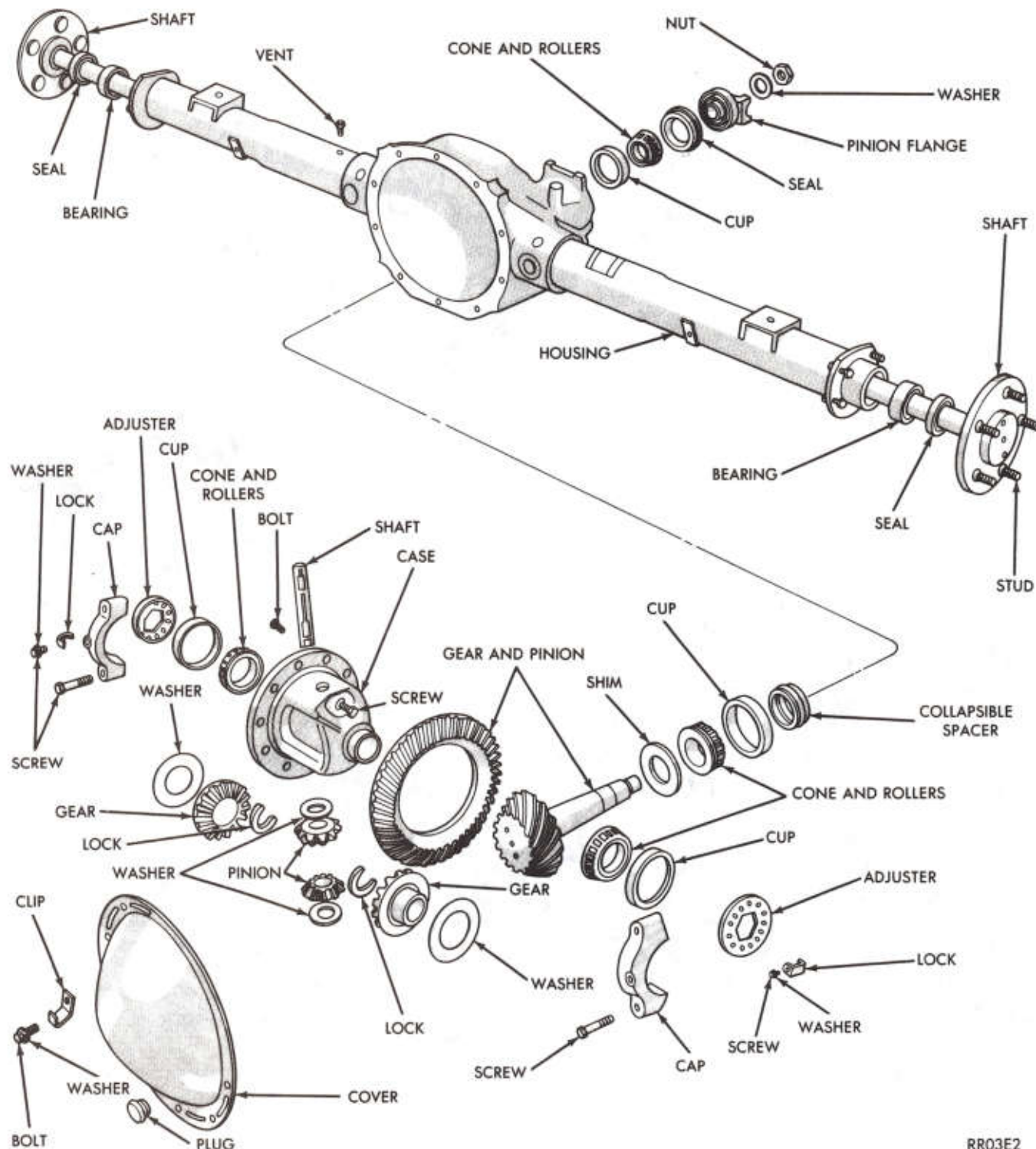
RR03E1

Fig. 1—8-3/8 Inch (212.72 mm) Rear Axle Assembly

The differential case is of one-piece construction. Two side gears and two pinion gears are housed within the case and are backed by thrust washers. The two side gears are splined internally to drive each of the axle shafts, and are positioned to turn in machined counterbores in the case. The differential pinion gears have a smooth surface and are held in

position by a solid pinion shaft mounted and locked in the case by means of a lock screw. All four of the gears are in mesh with each other, and because the differential pinions turn freely on the pinion shaft, they act as idler gears when the rear wheels are turning at different speeds.

The differential case is supported in the carrier by



RR03E2

Fig. 2—9-1/4 Inch (234.95 mm) Rear Axle Assembly (STD and HD)

two tapered roller bearing cones which are a press-fit on the differential case hubs. A threaded differential bearing adjuster with a hex drive hole is located in each bearing pedestal cap and performs two functions. They adjust and maintain the backlash between the ring gear and drive pinion; and establish a means of obtaining differential bearing preload.

The rear axle shaft wheel bearings are of a straight roller type and roll directly on the axle shaft. The bearing consists of an outer race, bearing cage and rollers. The bearing assembly is a press-fit. The axle shaft slides into position through the seal and bearing. Both the seal and bearing rollers ride directly on a common ground journal surface on the axle shaft. The

axle shaft splines engage the differential side gear with a loose fit. The axle shaft has a machined circular groove near the inner end of the axle shaft. The axle shafts are retained in the assembly by means of the "C" locks positioned in the circular grooves. When the axle shafts and "C" locks are properly installed, the outer portion of the "C" lock will be positioned in the machined recess of the side gear which will prevent the removal of the axle shaft. With the differential pinion shaft installed, and retained by its lock screw, axle shaft retainers are securely locked in place and cannot slide out. Therefore, with the axial movement of the axle shafts controlled in this way, no axle shaft bearing end play adjustment is required.

SERVICE PROCEDURES

AXLE SHAFT AND BEARINGS

Removal and Disassembly

- (1) Raise vehicle to a good desirable working height and remove the rear wheel and tire assembly and brake drum.
- (2) Clean all dirt and foreign material from area of housing cover.
- (3) Loosen housing cover and drain lubricant from rear axle and proceed to remove cover.
- (4) Turn differential case to make differential pinion shaft lock screw accessible and remove lock screw and pinion shaft (Fig. 3).
- (5) Push axle shafts toward center of vehicle and remove the "C" locks from recessed groove of axle shaft (Fig. 4).
- (6) Remove axle shaft from housing being careful not to damage the straight roller type axle shaft bearing which will remain in the rear axle housing.
- (7) Inspect the axle shaft bearing surfaces for signs of brinnelling, spalling or pitting. If any of these

The axle shaft bearings are lubricated by means of rear axle lubricant level being maintained in the tubes of the housing during operation.

A Sure-Grip Differential is available as optional equipment. It is a two piece construction and will be serviced as a complete assembly only. Refer to the Sure-Grip Differential Section of this Group for the servicing procedure.

Each axle is equipped with a remote vent. On the 8-3/8 inch axle it is located on the right leg, and on the left on the 9-1/4 inch axle.

Should the rear axle become submerged in water, the lubricant must be changed immediately to avoid the possibility of early axle failure resulting from contamination of the lubricant by water.

conditions are present, both the shaft and the bearing should be replaced. The normal bearing contact on the shaft will be a dull gray and may appear lightly dented.

- (8) Remove axle shaft seal from housing bore.

(9) Inspect axle shaft bearing while still in housing. Remove bearing if axle shaft or bearing show any of these conditions described in step 7. To remove the axle shaft bearing from the 8-3/8" and 9-1/4" (STD) axle housing (Fig. 5), use Tool C-4167. Attach Tool C-637 to end of selected remover, using a slide hammer motion. On the 9-1/4" (HD) axle housing, use Tool C-4828 (Fig. 6). Never reuse an axle shaft seal or bearing under any circumstances once it has been removed.

Assembly and Installation

- (1) Wipe axle shaft bearing cavity of axle housing clean.
- (2) Insert new axle shaft bearing onto pilot of

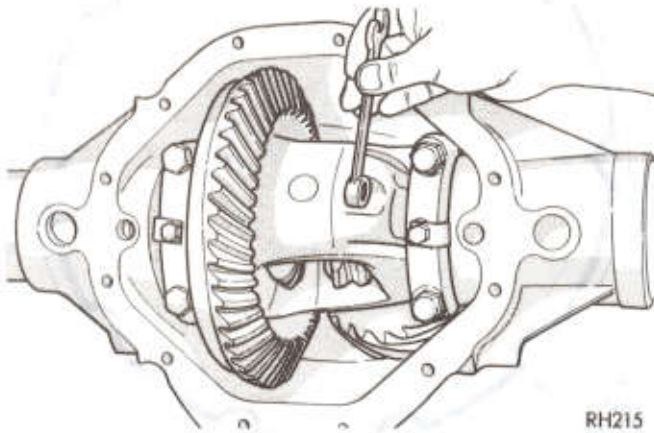


Fig. 3—Removal or Installation of Differential Pinion Shaft Lock Pin

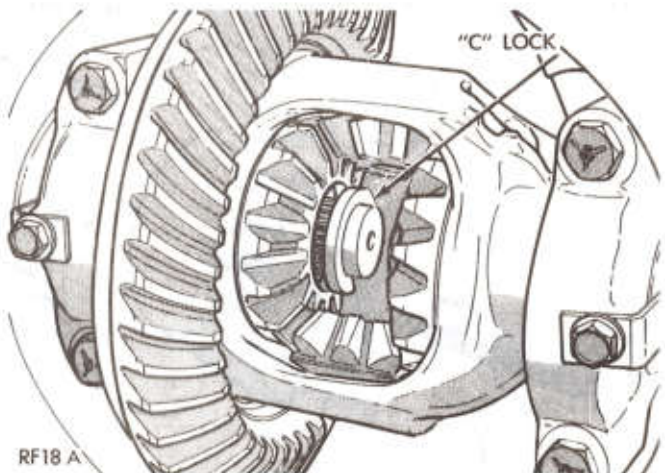
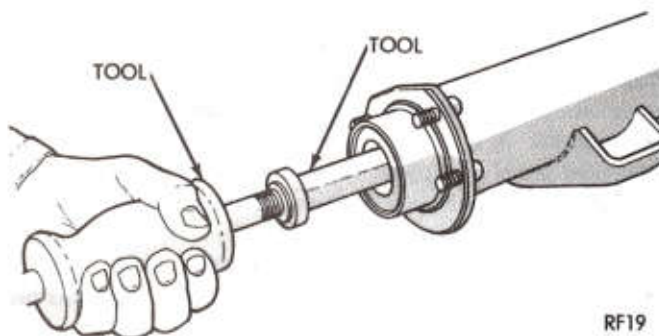


Fig. 4—Removal or Installation of Axle Shaft "C" Locks



RF19

Fig. 5—Removing 8-3/8 Inch and 9 1/4 (STD) Axle Shaft Bearing and Seal

proper Bearing Installer (Tool C-4198 for 8-3/8" and 9-1/4" STD) or (Tool C-4826 with 9-1/4" HD) and handle C-4171. Insert axle shaft bearing into cavity making sure it is not cocked in bore and bottoms against the shoulder.

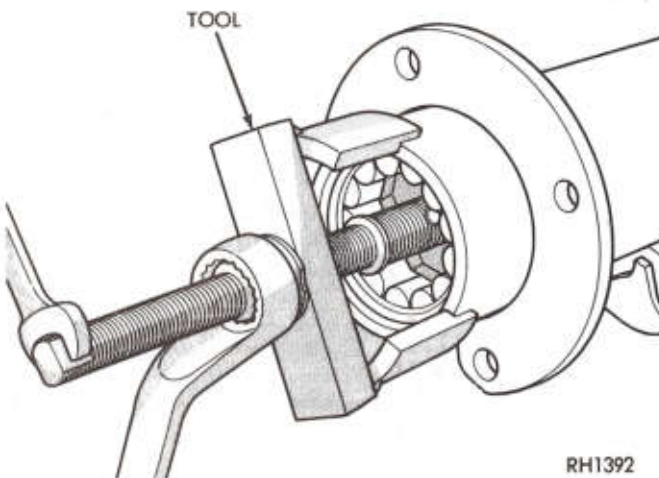
CAUTION: Under no circumstances should the seal be used to position or bottom the bearing in its bore as this would damage the seal.

(3) Install new axle shaft bearing seal (Fig. 7) on the 8-3/8" and 9-1/4" (STD) axle using Tool C-4203 and handle C-4171, **flat side of tool must be against seal**. Use Tool C-4826 on 9-1/4" (HD) axle. When the tool bottoms against the housing face the seal will be positioned to the proper depth.

(4) Lubricate bearing and seal lip, slide axle shaft into place being careful that splines of shaft do not damage oil seal and properly engage with splines of differential side gears.

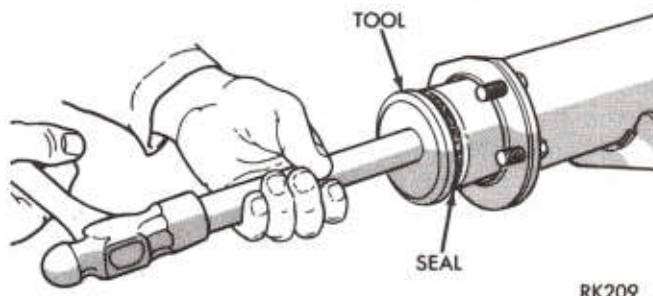
(5) With axle shaft in place, install the "C" locks in recessed grooves of axle shaft, and pull outward on shaft so the "C" lock seats in the counterbore of differential side gear.

(6) Install differential pinion shaft through case, thrust washers and pinions, aligning hole in shaft with lock screw hole. Install lock screw and tighten



RH1392

Fig. 6—Removing 9-1/4 Inch (HD) Axle Shaft Bearing and Seal



RK209

Fig. 7—Installing Axle Shaft Oil Seal

securely.

(7) Scrape any gasket material from housing and cover and thoroughly clean surface with mineral spirits or equivalent and dry completely. Apply a 1/16 inch to 3/32 inch (1.6 to 2.4 mm) bead of MOPAR Silicone Rubber Sealant, Part No. 4318025 or equivalent (Fig. 8) along the bolt circle of the cover.

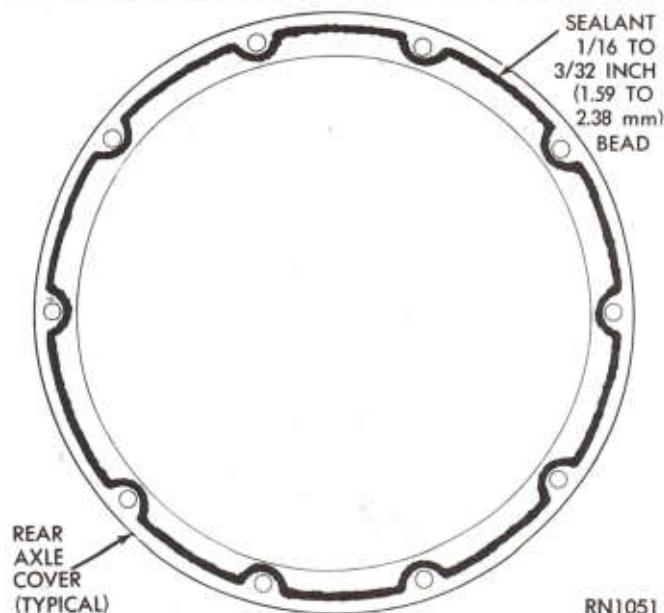
Install cover on axle and torque cover screws to 330-450 in. lbs. (37-51 N·m). Beneath one of the cover screws, install the ratio identification tag.

If for any reason cover is not installed within 20 minutes after applying sealant, old sealant should be removed and a new bead installed.

(8) Install brake drum and wheel and tire assembly, and tighten wheel nuts in the proper sequence (Fig. 9). Tighten wheel nuts to specifications (Refer to "Group 22 - Wheels and Tires").

(9) Raise or lower hoist until vehicle is in a level position.

(10) Remove fill plug and fill rear axle with lubricant (See specifications for quantity). Replace fill plug.



RN1051

Fig. 8—Proper Sealant Application to Rear Axle Housing Cover (Typical)

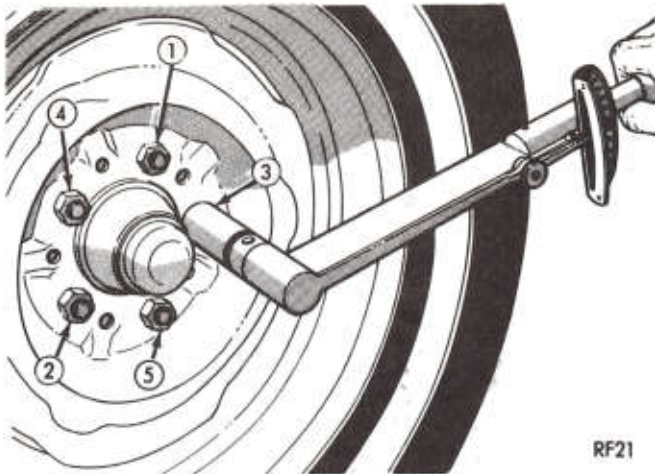


Fig. 9—Proper Wheel Nut Tightening Sequence

(11) Lower vehicle and test operation of brake and axle assembly.

REAR AXLE ASSEMBLY

It is not necessary to remove the complete axle assembly for any normal repairs. However, if the housing is damaged, the axle assembly may be removed and installed using the following procedure.

Removal

(1) Raise vehicle to a comfortable working height that will permit floor stands to be installed at front of rear springs.

(2) Block brake pedal in the "up" position using a wooden block.

(3) Loosen and remove rear wheels.

(4) Disconnect hydraulic brake lines at wheel cylinder and cap fittings to prevent loss of brake fluid.

(5) Disconnect parking brake cables.

To maintain proper drive line balance when reassembling, make scribe marks on the propeller shaft universal joint and the pinion flange before removal.

(6) Disconnect propeller shaft at differential pinion flange and secure in an upright position to prevent damage to front universal joint.

(7) Remove shock absorber lower bracket nuts, rubber bushings and washers. Remove rear spring U-bolt nuts and U-bolts.

(8) Remove axle assembly from vehicle.

(9) Using a suitable cleaning solvent wash and clean the outer surface of axle assembly and blow dry with compressed air.

Installation

(1) With body supported at front of rear springs, position rear axle assembly spring pads over the spring center bolts.

(2) Install spring U-bolts and install shock absorbers. Torque nuts to specifications (Refer to "Group

17 - Springs and Shock Absorbers").

(3) Connect parking brake cables.

(4) Connect hydraulic brake lines at wheel cylinders, adjust brakes and bleed brakes.

(5) Install rear universal joint of propeller shaft in same position as removed (match scribe marks on propeller shaft universal joint and pinion flange). Tighten universal joint clamps to 170-200 in. lbs. (19-23 N·m).

(6) Install rear wheels and tighten nuts in the proper tightening sequence (Refer to "Group 22 - Wheels and Tires").

DIFFERENTIAL RECONDITIONING

Removal and Disassembly

It is not necessary to remove the complete axle assembly to recondition the differential.

(1) Raise vehicle on hoist. Support body at front of rear springs and lower rear hoist.

(2) Remove rear wheels and brake drums.

(3) To maintain proper drive line balance when reassembling, make scribe marks on the propeller shaft universal joint and the pinion flange before removal. Disconnect propeller shaft at differential yoke and secure in an upright position to prevent damage to front universal joint.

(4) Loosen and remove housing cover screws, and remove cover to drain lubricant.

(5) Using a suitable cleaning solvent, wash and clean inside the axle housing and differential case and drive assembly.

(6) Turn differential case to make differential pinion lock screw accessible and remove lock screw and pinion shaft. Push both axle shafts toward center of vehicle and remove "C" locks from recessed groove of axle shaft.

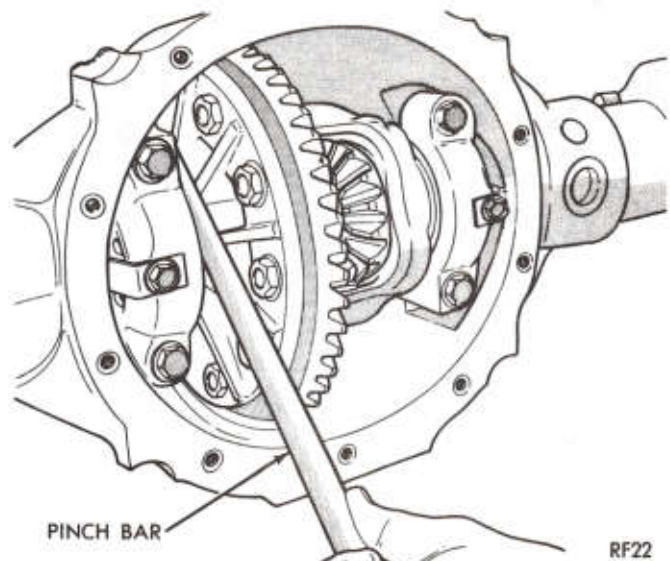


Fig. 10—Checking Differential Side Play

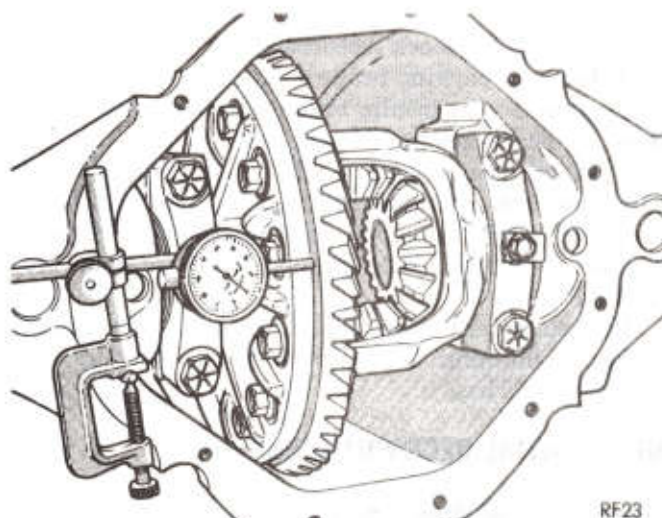


Fig. 11—Measuring Drive Gear Runout

(7) Remove axle shafts from housing being careful not to damage the straight roller type axle shaft bearings which will remain in the housing.

Side play and runout checks taken during disassembly will be very useful in reassembly.

(8) Measure for differential side play. Position a screwdriver or pinch bar between left side of axle housing and differential case flange, then using a prying motion determine if side play is present. **There should be no side play.** (Fig. 10).

Side play resulting from bearing cones becoming loose on differential case hubs requires replacement of case. Otherwise, use threaded adjuster to remove side play for check of drive gear runout.

(9) In preparing to measure drive gear runout on differential case, (provided no side play was found) mount a dial indicator Tool C-3339 on pilot stud C-3288-B, and load the indicator stem slightly with plunger at right angles to back face of drive gear (Fig. 11).

(10) Measure drive gear runout by turning drive

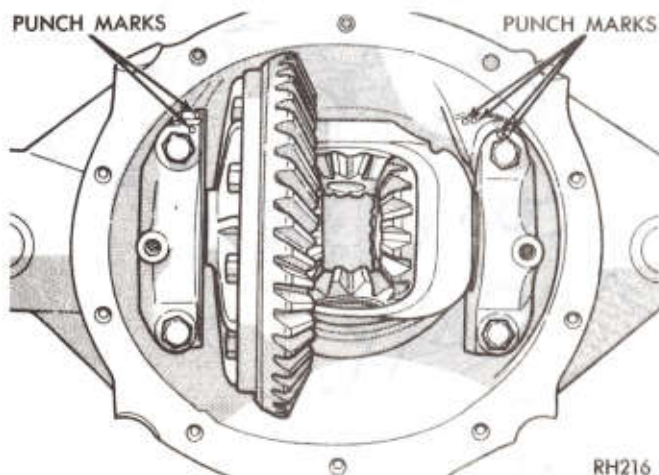


Fig. 12—Marking Bearing Caps and Housing for Proper Identification

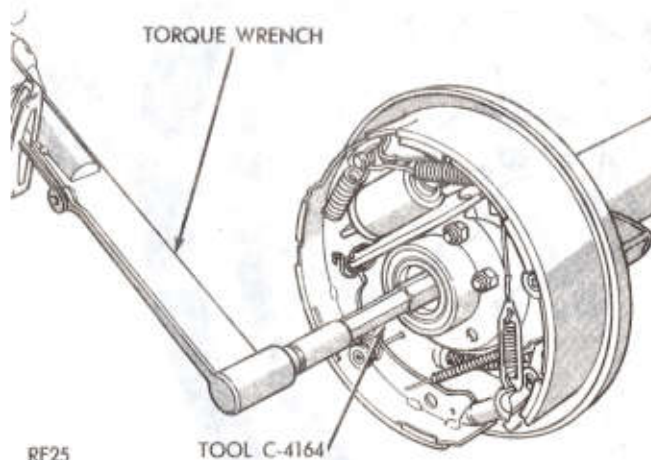


Fig. 13—Tool C-4164 Positioned to Loosen or Tighten Hex Adjuster

gear several complete revolutions and reading dial indicator. Mark drive gear and differential case at point of maximum runout. The marking of differential case will be very useful later in checking differential case runout. Total indicator reading should be no more than .005 inch (.13 mm). If runout exceeds .005 inch (.13 mm) the differential case may be damaged. A test for case runout will be described later.

(11) Mark axle housing and differential bearing caps for proper relocation during reassembly (Fig. 12).

(12) Remove adjuster lock from each bearing cap.

Loosen but do **not** remove bearing caps.

(13) Insert Tool C-4164 through axle tube on each side and loosen hex adjuster (Fig. 13).

(14) Place one hand on differential assembly to hold it in position. Using **extreme caution** remove bearing caps, adjusters and differential assembly (Fig. 14). Differential bearing cups and threaded adjusters must

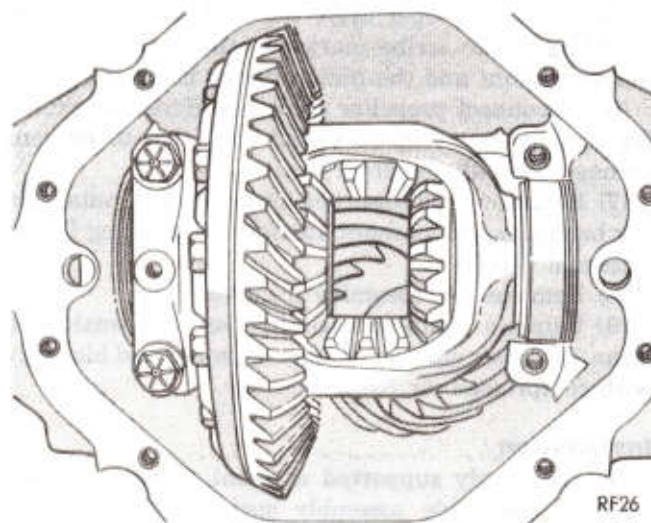


Fig. 14—Axle with One Bearing Cap Removed

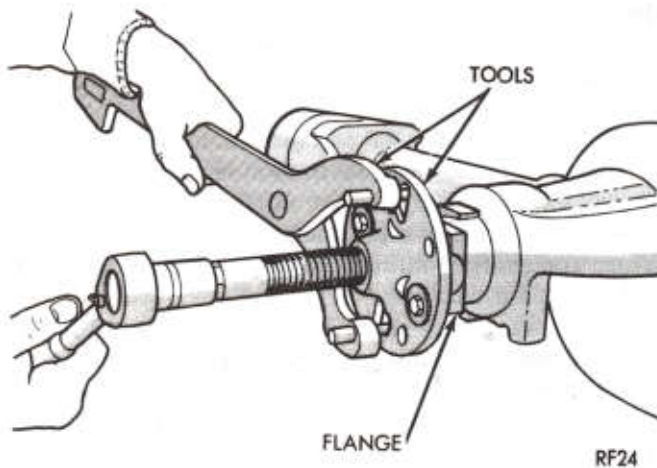


Fig. 15—Removing Drive Pinion Companion Flange

be kept with respective bearing cones.

(15) Using an inch-pound torque wrench, measure pinion bearing preload and record. Remove drive pinion nut and washer. Using Tool C-452 and holding Tool C-3281 remove drive pinion flange (Fig. 15).

(16) Using a screwdriver tip and hammer, remove the drive pinion oil seal from carrier casting and discard.

(17) To remove drive pinion or front pinion bearing cone, the pinion stem must be driven rearward out of the bearing. **This will result in damage to bearing rollers and cup and both bearing cone and cup must be replaced with new parts. Discard collapsible spacer.**

(18) Using Tool Set C-4306 removers and C-4171 handle, remove front and rear bearing cups from housing.

(19) Remove rear bearing cone from drive pinion stem. On 8-3/8 inch axles use Tool C-293-PA and C-293-42 adapters. On the 9-1/4 inch axles use Tool C-293-PA and C-293-37 adapters. Care must be taken to insure that the adapters are located so as not to pull on bearing cage (Fig. 16).

(20) Mount differential case and ring gear assembly in a vise equipped with soft jaws (brass).

Do not remove drive gear from case unless either the case or the gear set is to be replaced or if runout in step 11 exceeds .005 inch (.13 mm).

(21) Remove and discard drive gear bolts. **Bolts are left hand thread.** With non-metallic hammer or brass drift, tap drive gear loose from differential case pilot and remove.

(22) If drive gear runout exceeded .005 inch (.13 mm) in Step 11, differential case flange runout should be remeasured. Install differential case and respective bearing cups and adjusters in housing.

(23) Install bearing caps and bearing cap bolts. Tighten bearing cap bolts down lightly and using Tool C-4164 screw in both hex adjusters until all side play

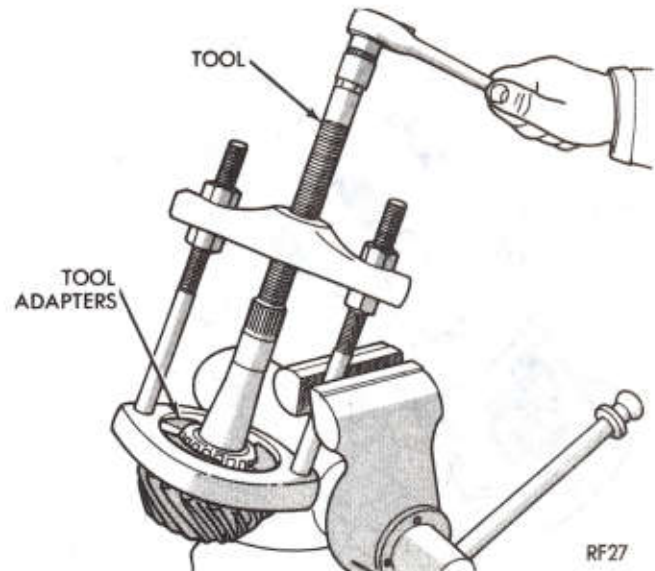


Fig. 16—Removing Drive Pinion Rear Bearing Cone

in bearings has been eliminated.

(24) Attach a dial indicator Tool C-3339 to housing so pointer of indicator squarely contacts drive gear surface of differential case flange between outer edge of flange and drive gear bolt holes.

(25) Rotate differential case several complete revolutions while noting total indicator reading. This reading must not exceed .003 inch (.08 mm) runout. If runout is in excess of .003 inch (.08 mm), differential case must be replaced. **In a case where the runout does not exceed .003 inch (.08 mm) it is often possible to reduce the runout by positioning the drive gear 180 degrees from point of maximum runout when reassembling drive gear on differential case (Fig. 17).**

(26) Loosen and remove pedestal cap bolts and remove differential case assembly from carrier and tube assembly.

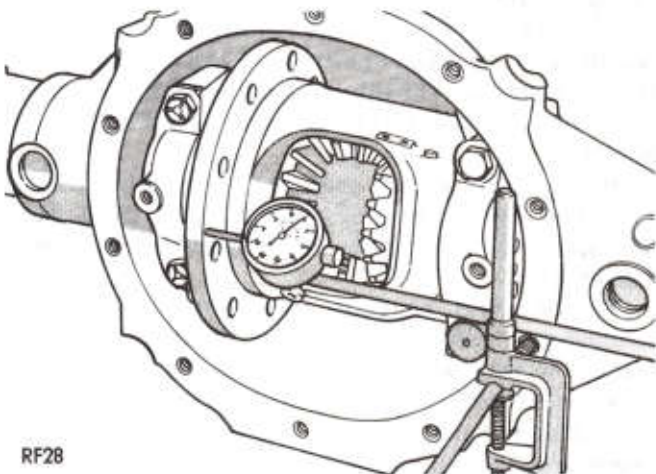


Fig. 17—Checking Drive Gear Mounting Flange Face Runout

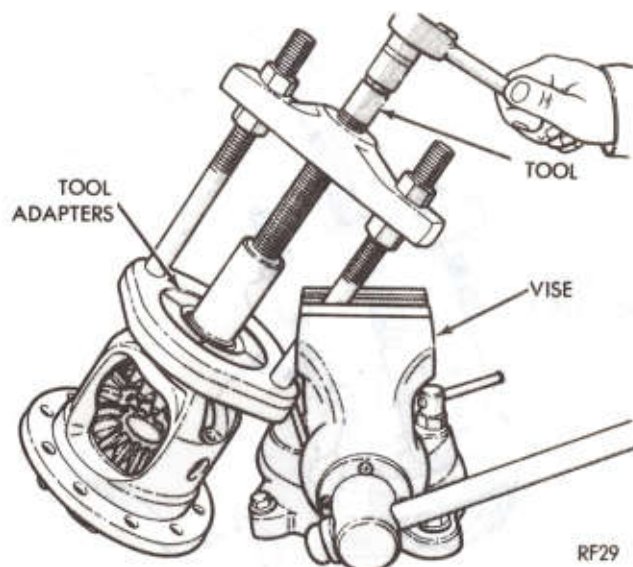


Fig. 18—Removing Differential Bearing Cone

(27) Rotate differential side gears until differential pinions appear at differential case window opening and remove.

(28) Remove differential side gears and thrust washers.

(29) Remove differential bearing cones. On 8-3/8 inch axles use Tool C-293-PA and adapters C-293-48 with SP-3289 plug. On 9-1/4 inch axles use Tool C-293-PA and adapters C-293-47 with C-293-3 plug (Fig. 18).

Cleaning and Inspection

(1) Wash and clean all parts in a suitable cleaning solvent and with the exception of bearings, dry with compressed air. To clean axle housing tubes, insert a stiff wire into tube, attach a clean cloth to wire at center section and withdraw from center outward.

(2) All machined contact surfaces in the axle housing and differential bearing caps should be smooth and free of any raised edges. Front and rear pinion bearing cup bore machine surfaces should be smooth. Raised metal on shoulders of bores incurred in removal of cups should be flattened by use of a flat nose punch.

(3) Axle shaft oil seal bores at both ends of housing should be smooth and free of rust and corrosion. This also applies to brake support plate and housing flange face surface.

(4) Axle shaft bearings should be washed and cleaned and inspected for pitting, spallings or imperfections in axle shaft roller surface or bearing rollers. If either or both are found to be unfit for further use, discard and replace with new parts. (The axle shaft and bearing should not be serviced separately).

(5) The axle shaft splines should be smooth and free of excessive wear. The axle shaft oil seal journal should be smooth and free of nicks, scratches or

blemishes. To remove any imperfections, polish with No. 600 crocus cloth (without reducing diameter of axle shaft oil seal surface).

(6) Differential bearings and front and rear pinion bearing cone and cup assemblies should have a smooth appearance with no broken or dented surfaces on rollers or roller contact surfaces. The bearing roller retainer cages must not be distorted or cracked. **When replacing bearings, always replace the cup and cone in a set only.**

(7) Inspect drive gear and pinion for worn or chipped teeth or damaged attaching bolt threads. If replacement is necessary, replace both the drive gear and drive pinion as they are available in matched sets only.

(8) Inspect universal joint flange for cracks, worn splines, pitted, rough or corroded oil seal contact surface. Repair or replace universal joint flange as necessary.

(9) Inspect drive pinion bearing shim for breakage or distortion and replace if necessary during the establishment of setting depth of mesh.

(10) Differential side gears and pinions should have smooth teeth with a uniform contact pattern without excessive wear or broken surfaces. The differential side gear hub surfaces and thrust washer contact surfaces should be smooth and free from any scoring or metal pickup.

(11) The machined thrust washer surface areas inside the differential case should be polished and with no surface imperfections. The pinion shaft bore in differential case should be round and without excessive wear in areas of contact with either differential case or differential pinions.

(12) Inspect axle shaft "C" locks for signs of cracks or wear and replace if necessary.

(13) Check each adjuster to determine that it rotates freely. If adjuster binds, repair damaged threads or replace adjuster as required to allow adjusters to turn freely.

Assembly and Installation

Liberal lubricate all components with rear axle lubricant.

(1) Install thrust washers on differential side gears and position gears in counterbores of differential case. If assembling with new differential gears or thrust washers refer to "Differential Side Gear Clearance Checking and Adjustment".

(2) Position thrust washers on both differential pinion gears and mesh the pinion gears with the side gears, having pinion gears exactly 180 degrees apart.

(3) Rotate side gears to align pinion gears and washers with differential pinion shaft holes in case.

(4) The contact surface of the drive gear and differential case flange must be clean and free of all burrs.

(5) Using an Arkansas stone, relieve the sharp edge

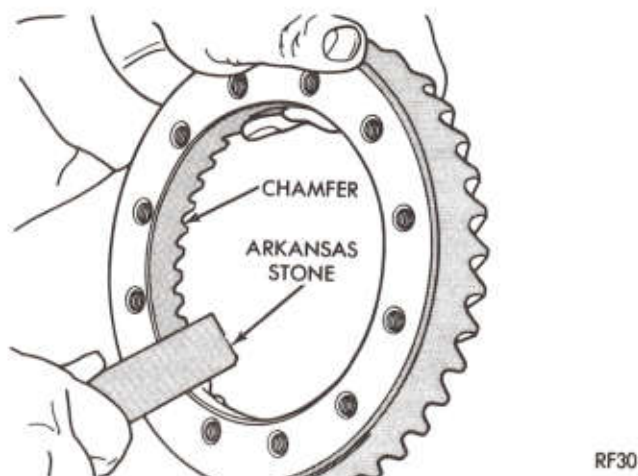


Fig. 19—Stoning Chamfer of Ring Gear

of the chamfer on the inside diameter of the ring gear (Fig. 19). This is very important otherwise during the installation of ring gear on differential case, the sharp edge will remove metal from the pilot diameter of case and can get imbedded between differential case flange and gear; causing ring gear not to seat properly.

(6) Heat the ring gear with a heat lamp or by immersing the gear in a hot fluid (water or oil). The temperature should not exceed 300 degrees Fahrenheit (148 Celsius). **Do not use a torch.** It is advantageous to use pilot studs equally spaced in three positions to align the gear to the case (Fig. 20).

(7) Using new drive gear screws (left hand threads) insert through case flange and into drive gear.

(8) Position unit between brass jaws of a vise and alternately tighten each screw to 70 ft. lbs. (95 N·m).

(9) Position each differential bearing cone on hub of differential case (taper away from drive gear) and carefully install bearing cones. On 8-3/8 inch axles use Tool C-4340 and C-4171 handle. On 9-1/4 inch axles use Tool C-4213 and C-4171 handle. An arbor

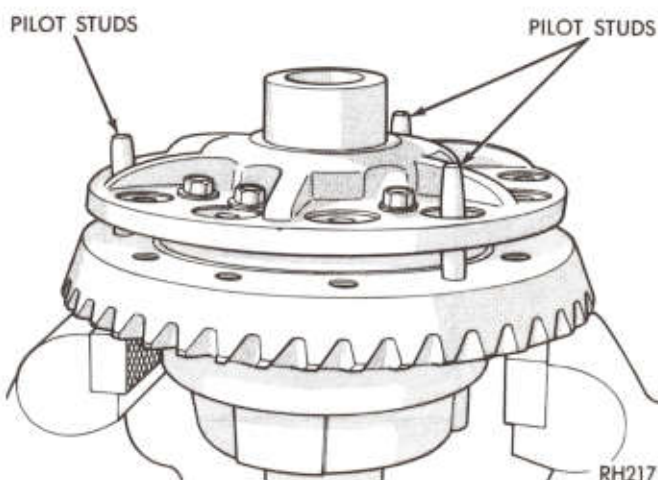


Fig. 20—Using Pilot Studs to Locate Case to Heated Ring Gear

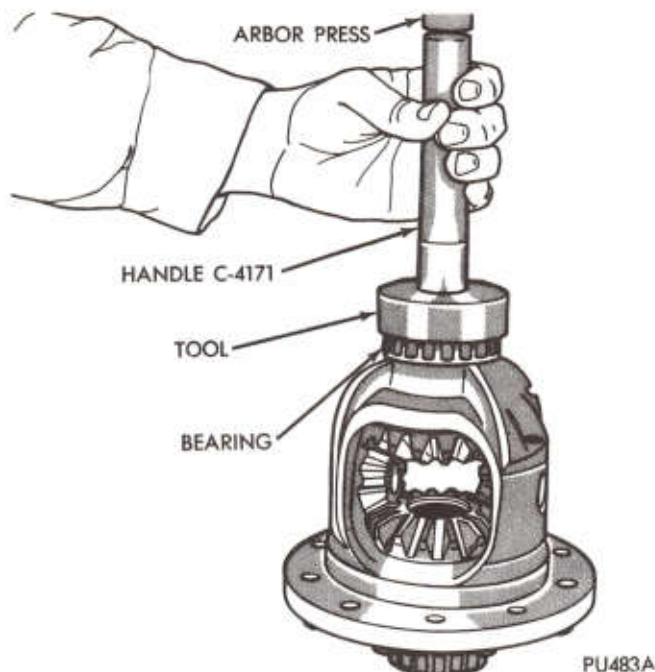


Fig. 21—Installing Differential Bearing Cone

press should be used in conjunction with installing Tool (Fig. 21).

CAUTION: Never exert pressure against the bearing cage, since this would damage the bearing.

Select the proper rear axle pinion setting gauge set (Figs. 22 and 23) and proceed as follows.

(10) Start both drive pinion bearing cups into axle housing bores making sure they are not cocked.

(11) **On 8-3/8 inch axles**, assemble pinion locating spacer SP-6030 over main body of Tool SP-5385 followed by rear bearing cone. Position tool in rear axle housing, then install shaft locating sleeve SP-5382, front pinion bearing cone, SP-6022 washer followed by compression sleeve SP-3194-B, centralizing washer SP-534 and compression nut SP-3193.

On 9-1/4 inch axles assemble pinion locating spacer SP-6017 over main body of Tool SP-526 followed by rear bearing cone. Position tool in rear axle housing,

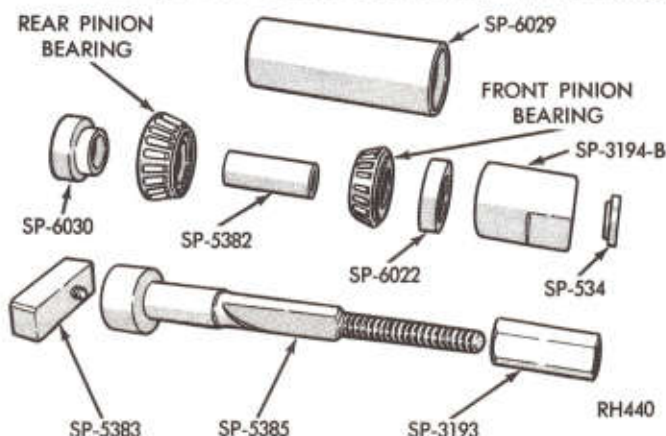


Fig. 22—8-3/8 Inch Rear Axle Setting Gauge Tool

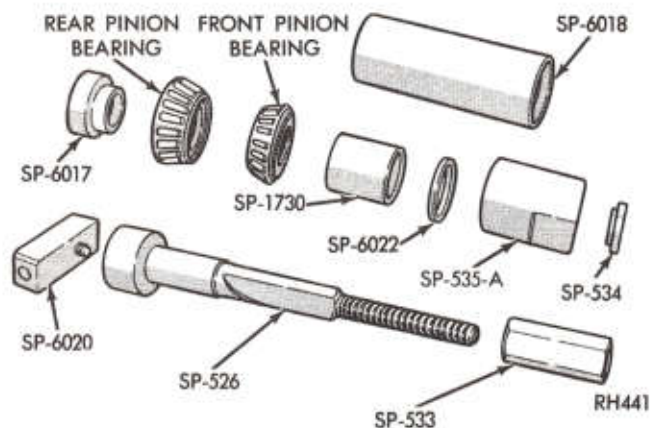


Fig. 23—9-1/4 Inch Rear Axle Pinion Setting Gauge Tool

then install shaft locating sleeve SP-1730, front bearing cone, compression sleeve SP-535-A, centralizing washer SP-534 and compression nut SP-533.

(12) While holding compression sleeve from turning with Tool C-3281, tighten nut, thereby drawing pinion bearing cups into axle housing bearing cup bores. Permit tool to turn several revolutions during tightening operation to prevent brinnelling of bearing cups or cones (Fig. 24).

The position of the drive pinion with respect to the drive gear (depth of mesh) is determined by the location of the bearing cup shoulders in the carrier and by the portion of the pinion in back of the rear bearing. A shim is located between the rear pinion bearing cone and the head of the pinion. The thickness of this shim will be determined next.

(13) Loosen compression nut. Lubricate front and rear pinion bearings with rear axle lubricant. Retighten nut to produce 15 to 25 in. lbs. (1 to 3 N·m) of rotating torque. Rotate pinion several complete revolutions to align bearing rollers.

(14) On 8-3/8 inch axles install gauge block SP-5383 on end of main body SP-5385, install cap screw

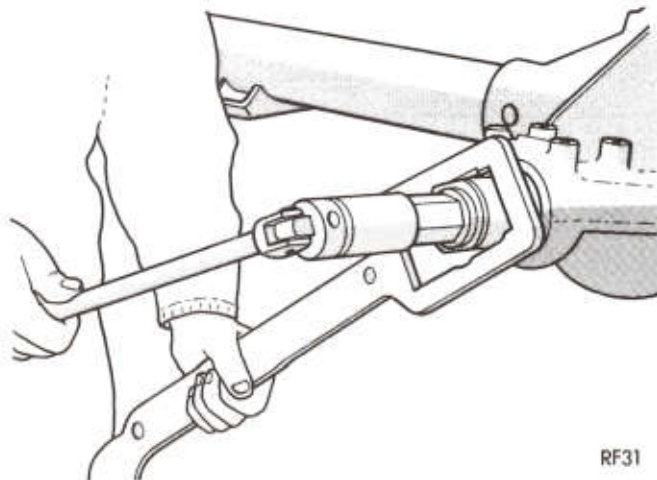


Fig. 24—Seating Bearing Cups in Axle Housing

SP-536 and tighten securely with SP-531 wrench.

On 9-1/4 inch axles install gauge block SP-6020 on end of main body SP-526, install cap screw SP-536 and tighten securely with SP-531 wrench.

(15) On 8-3/8 inch axles position crossbore arbor SP-6029 in axle housing differential bearing seats.

On 9-1/4 inch axles position crossbore arbor SP-6018 in axle housing differential bearing seats.

Center the arbor so that an approximate equal distance is maintained at both ends. Position bearing caps and attaching bolts on carrier pedestals and insert a piece of .002 inch shim stock between arbor and each cap. Tighten cap bolts to 10 ft. lbs. (14 N·m).

(16) Select rear pinion bearing mounting shim which will fit between crossbore arbor and gauge block (Fig. 25). This fit must be snug but not too tight (similar to the pull of a feeler gauge). Shims are available in .001 inch increments from .020 inch to .038 inch.

(17) Read the markings on the end of the pinion head (-0, -1, -2, +1, +2, etc.). When marking is - (minus), add that amount to the thickness of shims selected in step (16). When the marking is + (plus), subtract that amount. Treat other pinion markings in a similar manner.

(18) Remove the tool arbor and tool from axle housing.

(19) Position shim selected in step (16) on pinion followed by rear pinion bearing cone (make certain that pinion head contact surface, bearing cone and shim are clean and free from foreign particles). Using Tool C-4040 for 8-3/8 inch axles or Tool C-3095-A for 9-1/4 inch axles, press bearing on pinion stem. An arbor press may be used in conjunction with tool (Fig. 26).

(20) Lubricate front and rear pinion bearing cones with rear axle lubricant.

(21) Insert drive pinion and bearing assembly through axle housing. Install new collapsible spacer

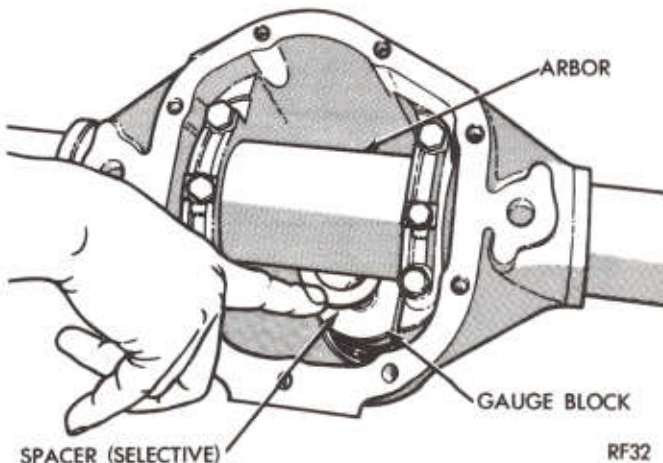


Fig. 25—Measuring Housing for Pinion Shim Thickness

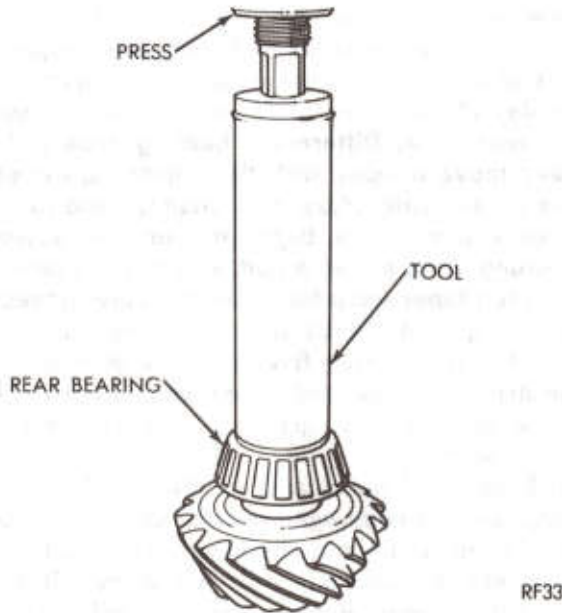


Fig. 26—Installing Drive Pinion Rear Bearing Cone

over pinion stem. Position front pinion bearing cone over pinion stem.

Install companion flange on the 8-3/8 inch axle using Tool C-3718 and holding Tool C-3281. On the 9-1/4 inch axle use Tool C-496 and holding Tool C-3281. This is necessary in order to properly install front pinion bearing cone on pinion stem due to interference fit (Fig. 27).

CAUTION: During installation of front pinion bearing cone, be careful not to collapse spacer.

(22) Remove tool and flange from pinion stem.

(23) Install drive pinion oil seal.

On 8-3/8 inch axles use Tool C-4076.

On 9-1/4 inch axles use Tool C-3980 or C-4109.

Seal is properly installed when seal flange contacts housing flange face (Fig. 28). Outside diameter of seal is precoated with a special sealer so no sealing compound is required.

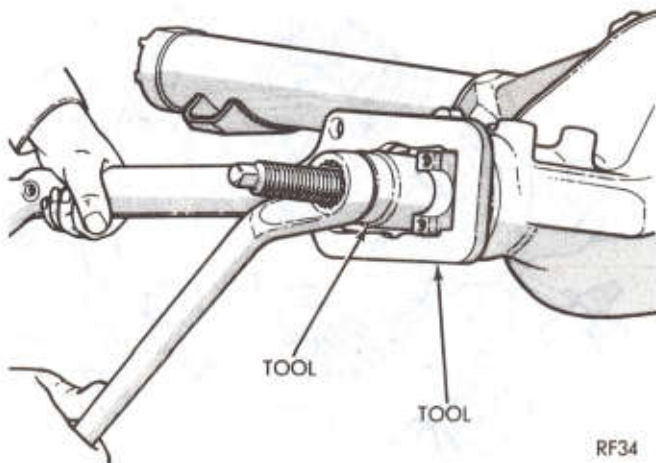


Fig. 27—Installing Drive Pinion Companion Flange

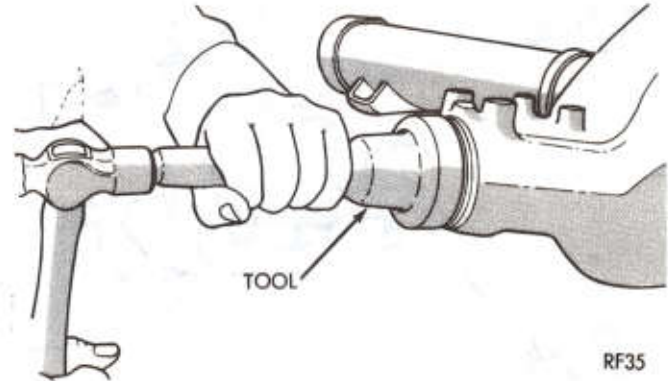


Fig. 28—Installing Drive Pinion Oil Seal

(24) While supporting pinion in carrier reinstall companion flange using tools previously described.

(25) Remove tools and install Belleville washer (convex side of washer out) and pinion nut.

(26) Hold universal joint flange with holding Tool C-3281 and tighten pinion nut to remove end play in pinion, while rotating the pinion to insure proper bearing roller seating (Fig. 29).

(27) Remove holding tool and rotate pinion several complete revolutions in both directions to permit bearing rollers to seat.

(28) Tighten pinion nut to 210 ft. lbs. (285 N·m) and measure pinion bearing preload by rotating pinion using an inch-pound torque wrench. The correct bearing preload specifications are 20 to 35 in. lbs. (2 to 4 N·m) for 8-3/8 and 9-1/4 inch axles with new bearings and the pinion nut tightened to 210 ft. lbs. (285 N·m) minimum (Fig. 30). If when rebuilding the axle and the **original** rear pinion bearing and a **new** front pinion bearing are used, the correct bearing preload is 10 in. lbs. (1 N·m) more than the reading taken at time of tear down with a minimum of 210 ft. lbs. (285

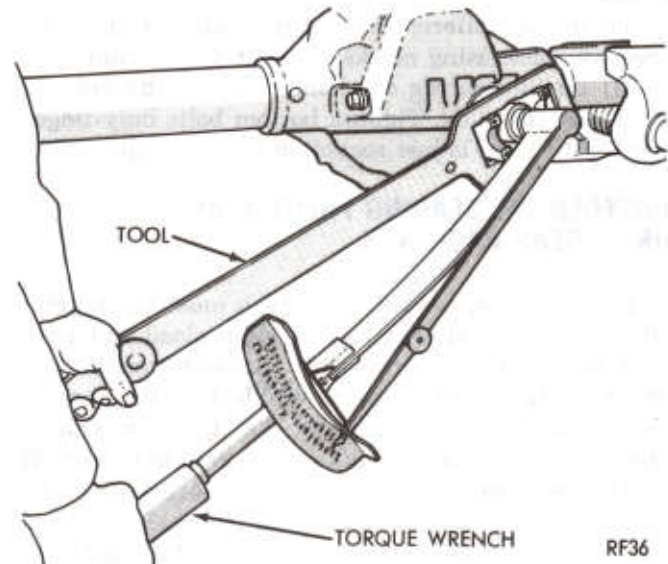


Fig. 29—Tightening Drive Pinion Nut

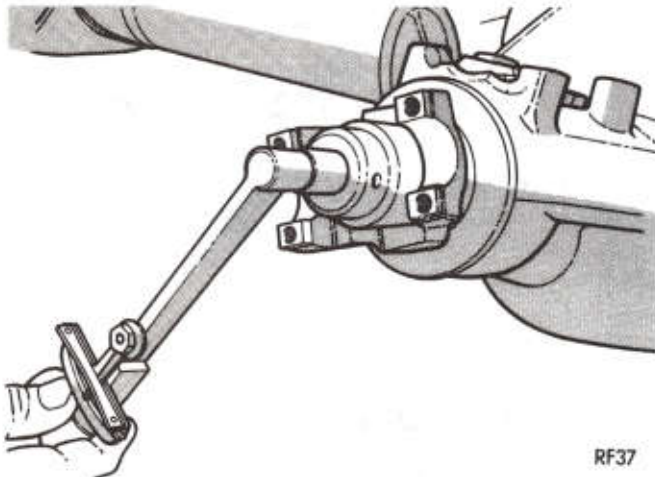


Fig. 30—Measuring Drive Pinion Bearing Preload

N·m) of torque on the pinion nut. If correct preload cannot be obtained at 210 ft. lbs. (285 N·m), continue tightening pinion nut in small increments and checking until proper preload is obtained. Bearing preload should be uniform during complete revolution. A preload reading that varies during rotation indicates a binding condition which must be corrected. The assembly is unacceptable if final pinion nut torque is below 210 ft. lbs. (285 N·m) or pinion bearing preload is not within specifications.

UNDER NO CIRCUMSTANCES SHOULD THE PINION NUT BE BACKED OFF TO LESSEN PINION BEARINGS PRELOAD. IF THE DESIRED PRELOAD IS EXCEEDED A NEW COLLAPSIBLE SPACER MUST BE INSTALLED AND NUT RETIGHTENED UNTIL PROPER PRELOAD IS OBTAINED.

(29) Coat differential bearing cones, cups and adjusters with axle lubricant. Carefully position differential assembly complete with bearing cups into housing.

(30) Install differential bearing caps on their respective sides, using marks made at disassembly.

(31) Install bearing cap bolts. Tighten **top** bolts to 10 ft. lbs. (14 N·m). Tighten bottom bolts only finger tight until head is just seated on bearing cap.

DIFFERENTIAL BEARING PRELOAD AND DRIVE GEAR BACKLASH

There are two precautions which must be observed when adjusting differential bearing preload and drive gear backlash. (A) Permissible backlash variation is .003 inch, for example, if the backlash is .006 inch at the minimum point, it may be .009 at the maximum point. This variation would be permissible runout. It is therefore important to index the gears so that the same teeth are engaged during all backlash measurements. (B) It is also important to maintain specified adjuster torque to obtain accurate differential bearing preload and drive gear backlash settings. Excessive

torque will introduce high bearing load and cause premature bearing failures. Inadequate torque will not support the drive gear properly and may lead to free play of the differential assembly and excessive drive gear noise. **Differential bearing cups will not always move directly with the adjusters, therefore to insure accurate adjustment changes and to maintain gear mesh index, bearings must be seated by oscillating drive pinion a half turn in each direction five to ten times each time adjusters are moved.**

(1) Using Tool C-4164 turn each hex adjuster in (Fig. 13) until bearing free play is eliminated with some drive gear backlash (approximately .010 inch) existing between drive gear and pinion. Seat rollers per note above.

(2) Install dial indicator Tool C-3339 (Fig. 31) and position contact point against drive side of gear tooth. To find point of minimum backlash, check backlash at 4 positions at approximately 90 degree intervals around drive gear. Rotate gear to position of least backlash. Mark the index so that all backlash readings will be taken with the same teeth in mesh.

(3) Loosen right adjuster and tighten left adjuster until the backlash is .003 to .004 inch (.08 to .10 mm) with each adjuster tightened to 10 ft. lbs. (14 N·m). Again seat bearings per note. Tighten differential bearing cap bolts to 70 ft. lbs. (95 N·m) on the 8-3/8 inch axles, 100 ft. lbs. (136 N·m) on 9-1/4 inch axles. Using Tool C-4164 tighten right adjuster to 75 ft. lbs. (102 N·m). Again seat bearings per note. Continue to tighten right adjuster and seat rollers until torque remains constant at 75 ft. lbs. (102 N·m). Measure backlash. If backlash does not measure between .006 to .008 inch (.15 to .20 mm), increase torque on right adjuster and seat bearings per note until correct backlash is obtained. Tighten left adjuster to 75 ft. lbs. (102 N·m). Seat bearings per note until torque remains constant. **If all previous steps have been properly performed, initial reading on left adjuster will be approximately 75 ft. lbs. (102 N·m). If it is**

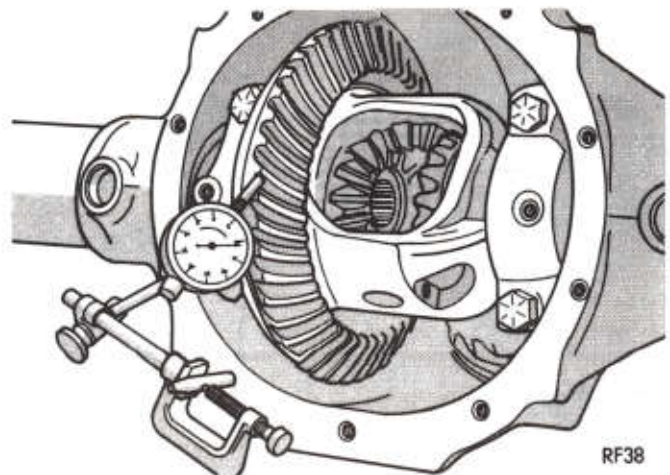


Fig. 31—Dial Indicator Installed to Check Backlash

substantially less, complete procedure must be repeated.

(4) When adjustments are completed, install adjuster locks. Be sure lock teeth on 9-1/4 inch axles are engaged in adjuster threads and lock finger is engaged in adjuster hole on 8-3/8 inch axles. Tighten lock screws to 90 in. lbs. (10 N-m).

DIFFERENTIAL SIDE GEAR CLEARANCE CHECKING AND ADJUSTMENT

Correct differential side gear clearance is obtained by selection of the correct thickness side gear thrust washer. Check parts catalog for the applicable side gear thrust washer package required. When measuring side gear clearance treat each gear independently. It is possible for one side to have an acceptable clearance and for the other side to require servicing. In situations where you find it necessary to replace a side gear, install two new ones as a matching set.

(1) With the axle shaft and "C" locks in place, measure the clearances behind each side gear by inserting a matched pair of gauges inserted on opposite sides of the hub (Fig. 32).

(2) If you measure .005" clearance, or less, see if the axle shaft on that side is contacting the pinion shaft. Do this with the gauges still in place behind the side gear. If the axle shaft does not contact the pinion shaft, the side gear fit is acceptable on that side. Repeat for other side.

(3) If you measured more than .005" clearance in step 1 and the axle shaft does not contact the differential pinion shaft, then record the side gear clearance. Remove the thrust washer and measure its thickness with a micrometer. Add the washer thickness to the side gear clearance you recorded. The sum of the two numbers will tell you which replacement washer to install. For example, if you find .007" side gear clearance, and measure thrust washer thickness at

.033" the total is .040". Install the thickest thrust washer from the service package that does not exceed the total above. In this case you would install the .037" washer from the service package, since the next larger size .042" would be too thick. When reassembled, side clearance should now be .004".

(4) In some cases the axle shaft will run up against the pinion shaft when feeler gauges are inserted behind the side gear. When this occurs, the "C" lock on the axle shaft prohibits the side gear from moving inward any farther. To find the total side gear clearance, measure the clearance again with the "C" lock out. Record your measurement with the "C" locks in place.

Remove the "C" lock on the side (or sides) having no axle shaft end play. While you have the differential apart, use a micrometer to measure the thrust washer thickness. Record your measurement and place the thrust washer back behind the side gear. Assemble the differential without the "C" lock installed and measure the side gear clearance again.

If the clearance changes less than .012 inch with the "C" locks removed, add the side gear clearance you recorded (when the "C" lock was in place) to the thrust washer thickness you measured with the micrometer. The total will help you determine which thrust washer to install. For example, if the clearance is .006 inch with the "C" lock in and .015 inch with the "C" lock removed, the change is .009 inch, less than .012 inch. So add .006 inch (the clearance with the "C" lock in place) to the thrust washer thickness; for example .032 inch. Your total is .038 inch. The closest thrust washer not exceeding .038 inch is .037 inch.

If the clearance increases more than .012 inch with the "C" lock removed, you need to replace both side gears and repeat the measurement tests.

If side gear clearance still exceeds .012 inch when using new side gears and the thickest thrust washers from the service package, then the differential case must be replaced.

GEAR TOOTH CONTACT PATTERN

(1) Apply a thin coat of Hydrated Ferric Oxide, commonly known as Yellow Oxide of Iron, or equivalent to both the drive and coast side of the drive gear teeth. Rotate drive gear one complete revolution in both directions while load is being applied with a round bar or screwdriver between the carrier casting and differential case flange. This action will leave a distinct contact pattern on both the drive and coast side of the drive gear teeth.

The gear tooth contact pattern will disclose whether the correct rear pinion bearing mounting shim has been installed and the drive gear backlash set properly. Backlash between the drive gear and pinion

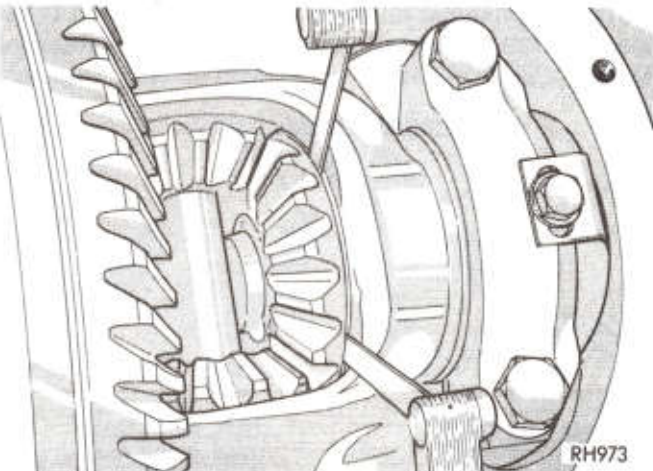


Fig. 32—Insert a Matched Pair of Thickness Gauges to Determine Clearance

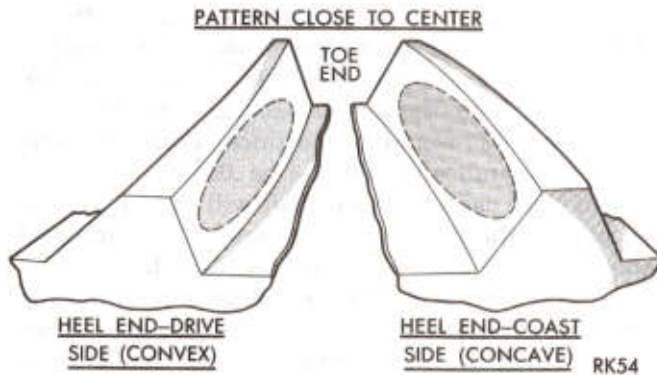


Fig. 33—Desired Tooth Contact Under Light Load

must be maintained within the specified limits until correct tooth contact pattern is obtained.

(2) Observe the contact pattern on the drive gear teeth and compare with those in Figs. 33 through 37 to determine if pattern is properly located. With pinion depth of mesh and gear backlash set properly, your contact pattern should resemble that in Fig. 33. Notice that the correct contact pattern is well centered on both drive and coast sides of the teeth. When tooth contact patterns are obtained by hand, they are apt to be rather small. Under the actual operating load, however, the contact area increases.

(3) If after observing the contact pattern you find it resembles that in Fig. 34, the drive pinion is too far away from centerline of the ring gear, the contact pattern will appear high on the heel on drive side and high on toe on coast side. To correct this type tooth contact pattern, increase the thickness of shim located between the drive pinion and rear pinion bearing cone (Fig. 35), which will cause the high heel contact on drive side to lower and move toward the toe; the high toe contact on coast side will lower and move toward the heel.

(4) If after observing the contact pattern you find it resembles that in (Fig. 36), the drive pinion is too close to the centerline of the ring gear, the pattern will appear low on the toe on drive side and low heel contact on coast side. To correct this type tooth

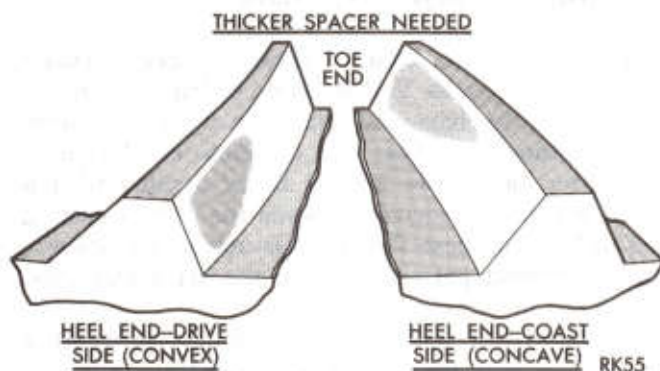


Fig. 34—Incorrect Tooth Contact Pattern (Increase Spacer Thickness)

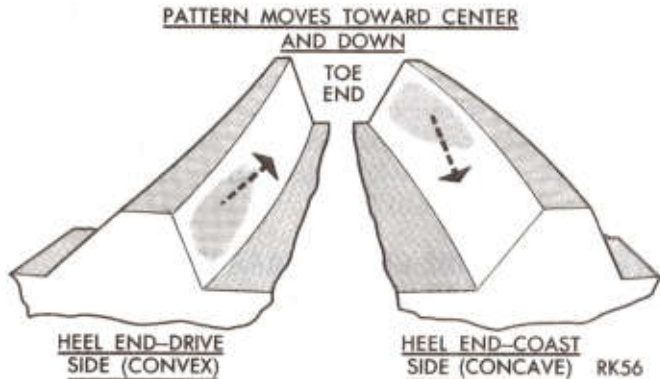


Fig. 35—Effect on Tooth Contact Pattern as Spacer Thickness is Increased

contact pattern, decrease the thickness of shim located between the drive pinion and rear pinion bearing cone (Fig. 37), which will cause the low toe contact on drive side to raise and move toward the heel; low heel contact on coast side will raise and move toward the toe.

(5) When correct tooth contact pattern is obtained, install propeller shaft, aligning scribe marks made during disassembly. Tighten clamp screws to 170 in. lbs. (19 N·m).

(6) Install new axle shaft bearing seals on the 8-3/8 and 9-1/4 inch (STD) axles with Tool C-4203 and handle C-4171, flat side of tool must be against seal (Fig. 7). Use Tool C-4826 on the 9-1/4 inch (HD) axle. Carefully slide axle shafts in place, install the "C" locks in recessed grooves of axle shafts, pull outward on each shaft so "C" locks seat in counterbore of differential side gear.

(7) Install differential pinion shaft through case and pinions, aligning hole in shaft with lock screw hole. Install lock screw and tighten to 100 in. lbs. (11 N·m).

(8) Scrape any gasket material from housing and cover and thoroughly clean surface with mineral spirits or equivalent and dry completely. Apply a 1/16 inch to 3/32 inch bead of MOPAR Silicone Rubber Sealant, Part No. 4318025 or equivalent (Fig. 7) along

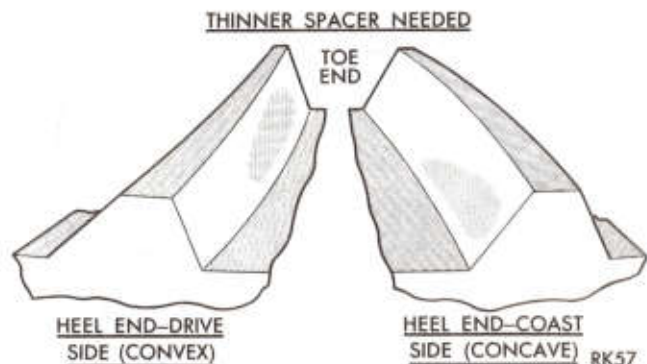


Fig. 36—Incorrect Tooth Contact Pattern (Decrease Spacer Thickness)

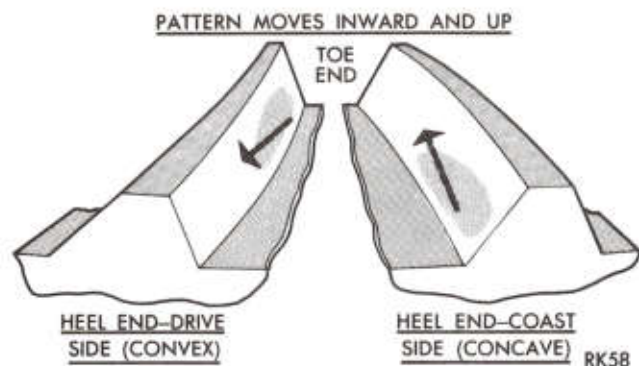


Fig. 37—Effect on Tooth Contact Pattern as Spacer Thickness is Decreased

the bolt circle of the cover.

Allow sealant to cure while cleaning carrier gasket flange with mineral spirits or equivalent. Dry surface completely. Install cover on axle and torque cover screws to 330-450 in. lbs. (37-51 N·m). Beneath one of the cover screws, install the ratio identification tag.

If for any reason cover is not installed within 20 minutes after applying sealant, old sealant should be removed and a new bead installed.

(9) Install brake drum and wheel and tire assemblies. Tighten wheel nuts to 85 ft. lbs. (115 N·m) in proper sequence (Fig. 8). Remove block from brake pedal.

(10) Raise rear hoist and remove stands. Raise or lower hoist so vehicle is in a level position.

(11) **On 8-3/8 inch axles** remove fill plug and fill rear axle with 4.4 pints (2L) of rear axle lubricant or until lubricant is between the bottom of the filler plug opening and a point 1/4 inch (6.4 mm) below the filler plug opening. Replace fill plug.

On 9-1/4 inch axles remove fill plug and fill rear axle with 4.5 pints (2.1 litres) or until lubricant is between the bottom of the filler plug opening and a point 1/4 inch (6.4 mm) below the filler plug opening. Replace filler plug.

(12) Lower vehicle and test operation of brake and axle assembly.

LUBRICATION

Multi-purpose Gear Lubricant, as defined by the American Petroleum Institute GL-5, should be used in all rear axles with conventional differentials; MOPAR Hypoid Lubricant Part No. 4318058 is an oil of this type and is recommended or equivalent.

“SHOULD THE REAR AXLE BECOME SUBMERGED IN WATER, THE LUBRICANT MUST BE CHANGED IMMEDIATELY TO AVOID THE POSSIBILITY OF EARLY AXLE FAILURE RESULTING FROM CONTAMINATION OF THE LUBRICANT BY WATER.

REMOVAL AND REPLACEMENT OF DRIVE PINION FLANGE AND OIL SEAL IN VEHICLE

The following procedure for the removal and replacement of the drive pinion flange and pinion oil seal must be followed to assure that the proper bearing preload is maintained in the axle assembly. If this procedure is not followed it could result in a premature failure of the axle.

(1) Raise vehicle on hoist and make scribe marks on propeller shaft, shaft universal joint, drive pinion flange and end of pinion stem.

(2) Disconnect propeller shaft at pinion flange and secure in an upright position to prevent damage to front universal joint.

(3) Remove the rear wheels and brake drums to prevent any drag or a possible false preload reading could occur.

(4) Using inch-pound torque wrench C-685-A measure pinion bearing preload by rotating pinion with handle of wrench floating, read the torque while wrench is moving through several complete revolutions and record. **This operation is very important because preload must be carefully reset when reassembling.**

(5) With Tool C-3281 hold companion flange and remove drive pinion nut and Belleville washer.

(6) Install companion flange remover Tool C-452 and remove flange. Lower rear of vehicle to prevent lubrication leakage.

(7) Using a screwdriver and hammer, remove the pinion oil seal from the carrier and clean the oil seal seat.

(8) Check splines on pinion shaft stem to be sure they are free of burrs or are not worn badly. If burrs are evident remove them using crocus cloth by working in a rotational motion. Wipe the pinion stem clean.

(9) Inspect companion flange for cracks, worn splines, pitted, rough or corroded oil seal contacting surface. Repair or replace companion flange as necessary.

(10) The outside diameter of the seal assembly is precoated with a special sealer so no sealing compound is required for installing. Install new drive pinion oil seal.

On 8-3/8 inch axles use Tool C-4076.

On 9-1/4 inch axles use Tool C-3980 or C-4109.

Seal is properly installed when seal flange contacts housing flange face.

(11) Position companion flange on pinion stem being careful to match scribe marks made previously before removal.

(12) Install companion flange using Tool C-3718 and holding Tool C-3281.

(13) Remove tool and install Belleville washer (convex side of washer out) and pinion nut.

(14) Hold universal joint flange with holding Tool C-3281 and tighten pinion nut to 210 ft. lbs. (285 N·m). Rotate pinion several complete revolutions to assure that bearing rollers are properly seated. Using an inch-pound torque wrench C-685-A, measure pinion bearing preload. Continue tightening pinion nut and checking preload until preload is at the original established setting you found in Step 4. Under no circumstances should the preload be more than 10 in. lbs. (1 N·m) over the established setting found at time of checking in Step (4) of procedure.

Bearing preload should be uniform during a complete revolution. A preload reading that varies during rotation indicates a binding condition which has to be corrected. The assembly is unacceptable if final pinion nut torque is below 210 ft. lbs. (285 N·m) or pinion bearing preload is not within the correct speci-

cations.

CAUTION: Under no circumstances should the pinion nut be backed off to lessen pinion bearing preload. If the desired preload is exceeded a new collapsible spacer must be installed and nut re-tightened until proper preload is obtained. In addition, the universal joint flange must never be hammered on or power tools used.

(15) Install propeller shaft (match scribe marks on propeller shaft universal joint and pinion flange). Tighten clamp screws to 170 in. lbs. (19 N·m).

(16) Install the rear brake drums and wheels and tighten nuts in the proper tightening sequence (Refer to "Group 22 - Wheels and Tires").

(17) Raise the vehicle to a level position so axle assembly is at correct running position and check lubricant level. Add the correct type of lubricant required to bring the lubricant to proper level.

SURE GRIP DIFFERENTIAL

INDEX

	Page
General Information	22
Lubrication	24
Service Diagnosis	1
Service Procedures	23
Sure-Grip Differential	24
Assembly and Installation	24

	Page
Cleaning and Inspection	24
Identification	23
Noise	23
Removal	24
Testing	24

GENERAL INFORMATION

CAUTION: Anytime rear axle servicing is necessary, or axle is being rotated through use of the engine or other means, **ELEVATE BOTH REAR WHEELS.**

This **Sure-Grip** differential is being offered as a special equipment option (Fig. 1).

The **Sure-Grip** differential design is basic and simple and consists of a two piece case construction and is

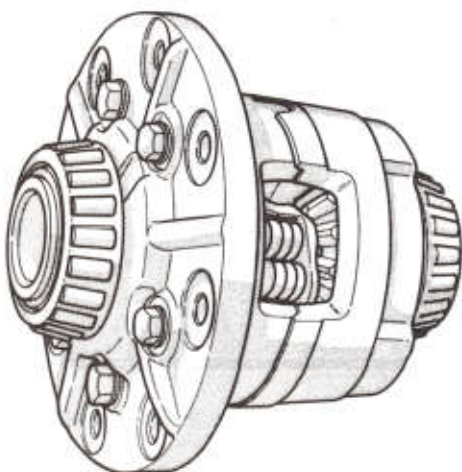


Fig. 1—Sure Grip Differential

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completely interchangeable with the conventional differential (Fig. 2).

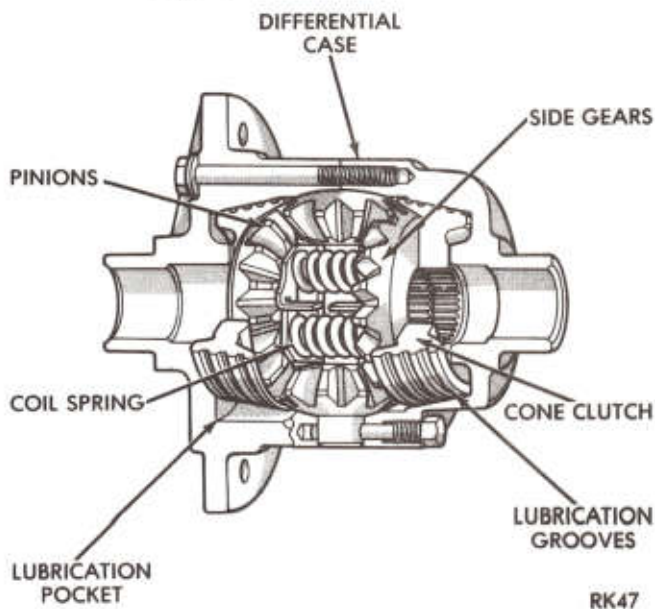


Fig. 2—Sure Grip Differential (Schematic)

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A conventional differential allows the driving wheels to rotate at different speeds while dividing the driving torque equally between them. This function is ordinarily desirable and satisfactory. However, the total driving torque can be no more than double the torque at the lower-traction wheel. When traction conditions are not the same for both driving wheels, a portion of the available traction cannot be used.

The **Sure-Grip** differential allows the driving wheel with the better traction condition to develop more driving torque than the other wheel, so that the total driving torque can be significantly greater than with a conventional differential.

Sure-Grip is not a locking differential. In normal driving conditions the controlled internal friction is easily overcome during cornering and turning so that the driving wheels can turn at different speeds. Extreme differences in traction conditions at the driving wheels may permit one wheel to spin.

Sure-Grip has been engineered to perform its specialized functions with minimum effect on normal vehicle operations.

The cone clutch **Sure-Grip** differentials are similar to corresponding conventional differentials except for the incorporation of the helix-grooved cones that clutch the side gears to the differential case. The grooves assure maximum lubrication of the clutch

surface during operation. The cones and side gears are statically spring preloaded to provide an internal resistance to differential action within the differential case itself. This internal resistance provides pulling power while under extremely low tractive conditions such as mud, snow, or ice when encountered at one of the rear wheels.

During torque application to the axle, the initial spring loading of the cones is supplemented by the gear separating forces between the side gears and differential pinions which progressively increases the friction in the differential. It should be remembered that this differential is not a positive locking type and will release before excessive driving force can be applied to one wheel.

SURE-GRIP DIFFERENTIAL IDENTIFICATION

Identification of **Sure-Grip** differential assembly can easily be made by lifting both rear wheels off the ground and turning them. If both rear wheels turn in the same direction simultaneously, the vehicle is equipped with a **Sure-Grip** Differential. Another means of identification is by removing the filler plug and using a flashlight to look through the filler plug hole to identify the type of differential case.

SERVICE PROCEDURES

Service Procedures for the **Sure-Grip** differential are basically the same as previously covered in the conventional section of this group, therefore only the differences will be covered here.

SURE-GRIP DIFFERENTIAL NOISE

(Chatter—Moan)

Noise complaints related to rear axles equipped with cone-clutch **Sure-Grip** should be checked to determine the source of the noise. If a vehicle ride check produces the noise in turns but not straight ahead, the probable cause is incorrect or dissipated rear axle lubricant. The following draining and flushing procedure has been established for the **Sure-Grip** Differential before it is removed from the vehicle and replaced.

CAUTION: When servicing vehicles equipped with Sure-Grip differentials do not use the engine to rotate axle components unless both rear wheels are off the ground. Sure-Grip equipped axles can exert a significant driving force if one wheel is in contact with floor and could cause the vehicle to move.

(1) With lubricant of rear axle assembly at operating temperature raise vehicle on hoist so rear wheels are free to turn. Install jack stands.

(2) Remove axle cover and drain and discard lubri-

cant. Rotate differential so hole in case is facing down. Wipe out all accessible areas of carrier.

The purpose of draining and discarding this lubricant is to rid the axle of any solid particles or liquid contaminants that may be contributing to the noise condition.

(3) Scrape any gasket material from housing and cover and thoroughly clean surface with mineral spirits or equivalent and dry completely. Apply a 1/16 inch to 3/32 inch (1.59 to 2.38 mm) bead of MOPAR Silicone Rubber Sealant, Part No. 4318025 or equivalent (See Figure 6 in Conventional Axle Section of this Group) along the bolt circle of the cover.

Install cover on axle and torque cover screws to 330-450 in. lbs. (37-51 N·m). Beneath one of the cover screws, install the ratio identification tag.

If for any reason cover is not installed within 20 minutes after applying sealant, old sealant should be removed and a new bead installed.

(4) Remove jack stands. Raise or lower hoist until vehicle is in a level position.

(5) Remove filler plug. Install 4 ounces of MOPAR Hypoid Gear Oil Additive Friction Modifier, Part No. 4318060 or equivalent in the axle. Refill axle to proper level with MOPAR Hypoid Lubricant, Part No. 4318058 or equivalent.

(6) Install filler plug. Lower vehicle.

TESTING SURE-GRIP DIFFERENTIAL

The **Sure-Grip** differential can be checked to determine if its performance is satisfactory without removing the differential and carrier assembly from the vehicle.

(1) Position vehicle on a hoist with engine off and the transmission selector lever in park if automatic or in low gear if manual.

(2) Attempt to rotate wheel by applying turning force with hands gripping tire tread area.

(3) If you find it extremely difficult, if not impossible to manually turn either wheel, you can consider the **Sure-Grip** differential to be performing satisfactorily. If you find it relatively easy to continuously turn either wheel the differential is not performing properly and should be removed and replaced. The **Sure-Grip** Differential and internal parts are serviced as a complete assembly only. **Under no circumstances should the differential be removed and disassembled and reinstalled.**

SURE-GRIP DIFFERENTIAL

CAUTION: During removal and installation of axle shafts, **DO NOT** rotate an axle shaft unless both are in position. Rotation of one axle shaft without the other in place may result in misalignment of the two spline segments with which the axle shaft spline engages, and will necessitate realignment procedures when shaft is installed.

Removal

Follow the same procedure outlined under conven-

tional differential removal.

Cleaning and Inspection

(1) Clean the **Sure-Grip** differential assembly in a fast evaporating mineral spirits or a dry cleaning solvent and with exception of bearings, dry with compressed air.

(2) Inspect differential bearing cones, cups and rollers for pitting, spalling or other visible damage. If replacement is necessary, remove bearing cones from differential case using procedure outlined in conventional axle section of this group.

(3) Visually inspect differential case for cracks or other visible damage which might render it unfit for further service.

Assembly and Installation

Follow the same procedure outlined under conventional differential installation.

LUBRICATION

Multi-Purpose Gear Lubricant, as defined by the American Petroleum Institute GL-5 should be used in all rear axles with conventional differentials; MOPAR Hypoid Lubricant, Part No. 4318058 is an oil of this type and is recommended or equivalent.

In Sure-Grip Differentials 4 ounces of MOPAR Hypoid Gear Oil Additive Friction Modifier, Part No. 4318060 or equivalent must be included with this fill.

Should the rear axle become submerged in water, the lubricant must be changed immediately to avoid the possibility of early axle failure resulting from contamination of the lubricant by water.

REAR AXLE ASSEMBLY SPICER 60, 60M, and 70

INDEX

	Page		Page
Axle Shafts	25	Gear Tooth Contact Pattern	38
Removal and Installation	25	General Information	24
Differential	27	Lubrication	38
Assembly and Installation	29	Pinion Bearing Preload	34
Cleaning and Inspection	29	Rear Axle Assembly	26
Removal and Disassembly	27	Installation	26
Differential Bearing Preload and Drive Gear		Removal	26
and Pinion Backlash	37	Service Diagnosis	1
Drive Pinion Depth of Mesh Setting Using		Service Procedures	25
Pinion Depth Gauge Tool Set D-271	31	Specifications	40
Drive Pinion Depth of Mesh Setting Using		Tightening Reference	41
Tool C-758-D6	36	Wheel Bearing Adjusting Procedure	26

GENERAL INFORMATION

CAUTION: Whenever rear axle servicing is necessary, or axle is being rotated through use of the engine or other means, **ELEVATE BOTH REAR WHEELS. On four wheel drive vehicles, ELEVATE ALL FOUR WHEELS.**

The rear axle is of the integral carrier-housing, hypoid gear type in which the centerline of the drive pinion is mounted below the centerline of the ring gear (Figs. 1 and 2).

The rear axle housing is an iron casting with

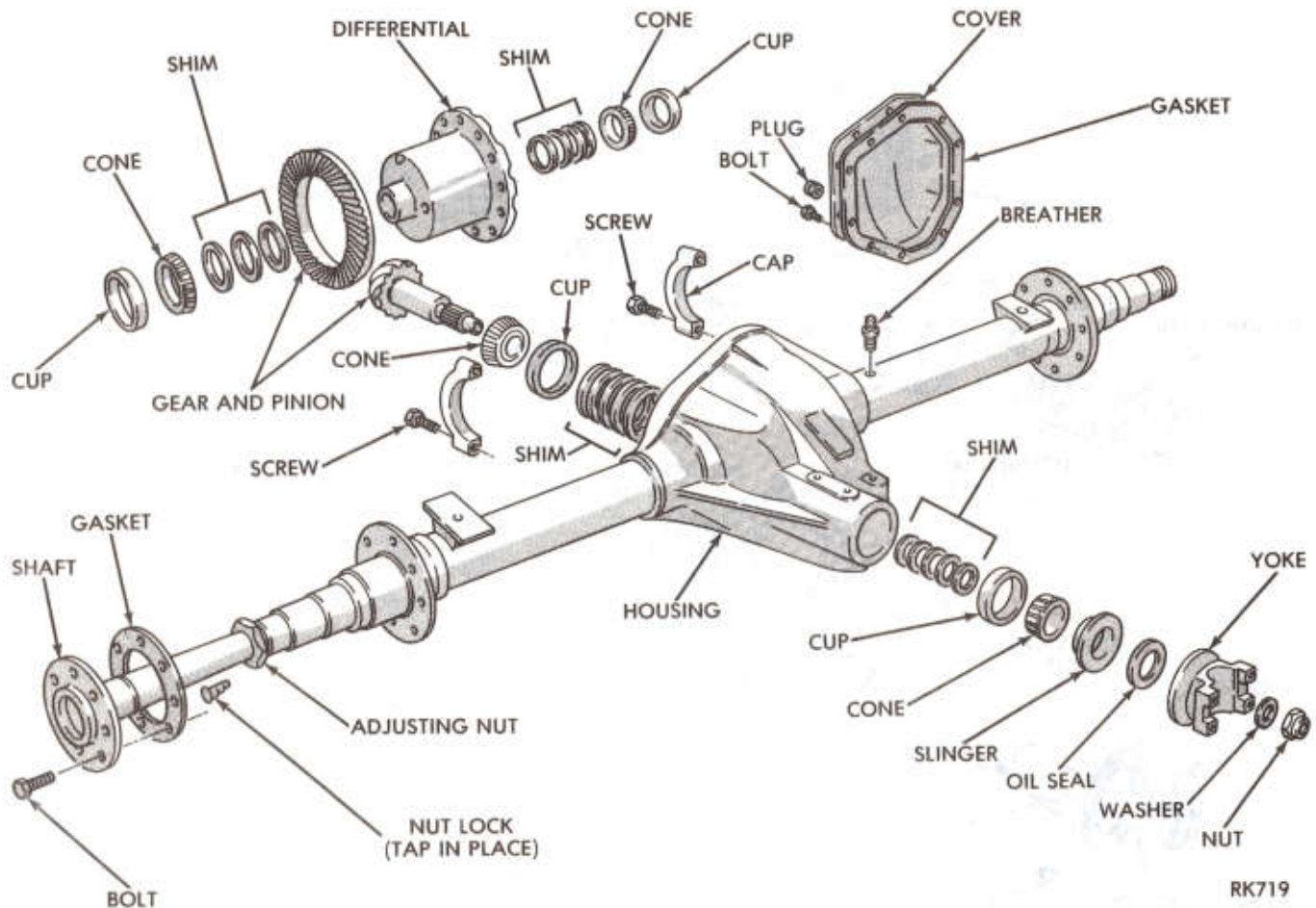


Fig. 1—60 and 60M Rear Axle Assembly

tubular legs pressed into and welded to the carrier to form a carrier and tube assembly. A removable stamped steel cover is bolted to the rear of the carrier to permit visual inspection of the differential without removing the complete rear axle from the vehicle.

A small metal tag is attached beneath one of the cover screws to identify the axle ratio. This tag is stamped with the number of teeth on the drive pinion and ring gear and the axle ratio.

The drive pinion is supported by two preloaded taper roller bearing. The rear pinion bearing cone is a tight press-fit on the pinion stem. The front pinion bearing is a light-press fit to a close sliding fit on the pinion stem. The front and rear bearing cups are a press-fit against a shoulder recessed in the carrier.

The drive pinion depth of mesh adjustment is controlled by locating shims, which are installed between the rear pinion bearing cup and the carrier casting.

Drive pinion bearing preload is maintained by using different thicknesses of shim packs between the drive pinion bearing shoulder and front pinion bearing cone.

The differential case is supported by two taper roller bearing cones which are a press-fit on the differential case hubs.

Shims installed between the bearing cones and shoulder of the differential case hub perform two functions: They adjust and maintain the backlash between the ring gear and drive pinion; and establish a means of obtaining differential bearing preload.

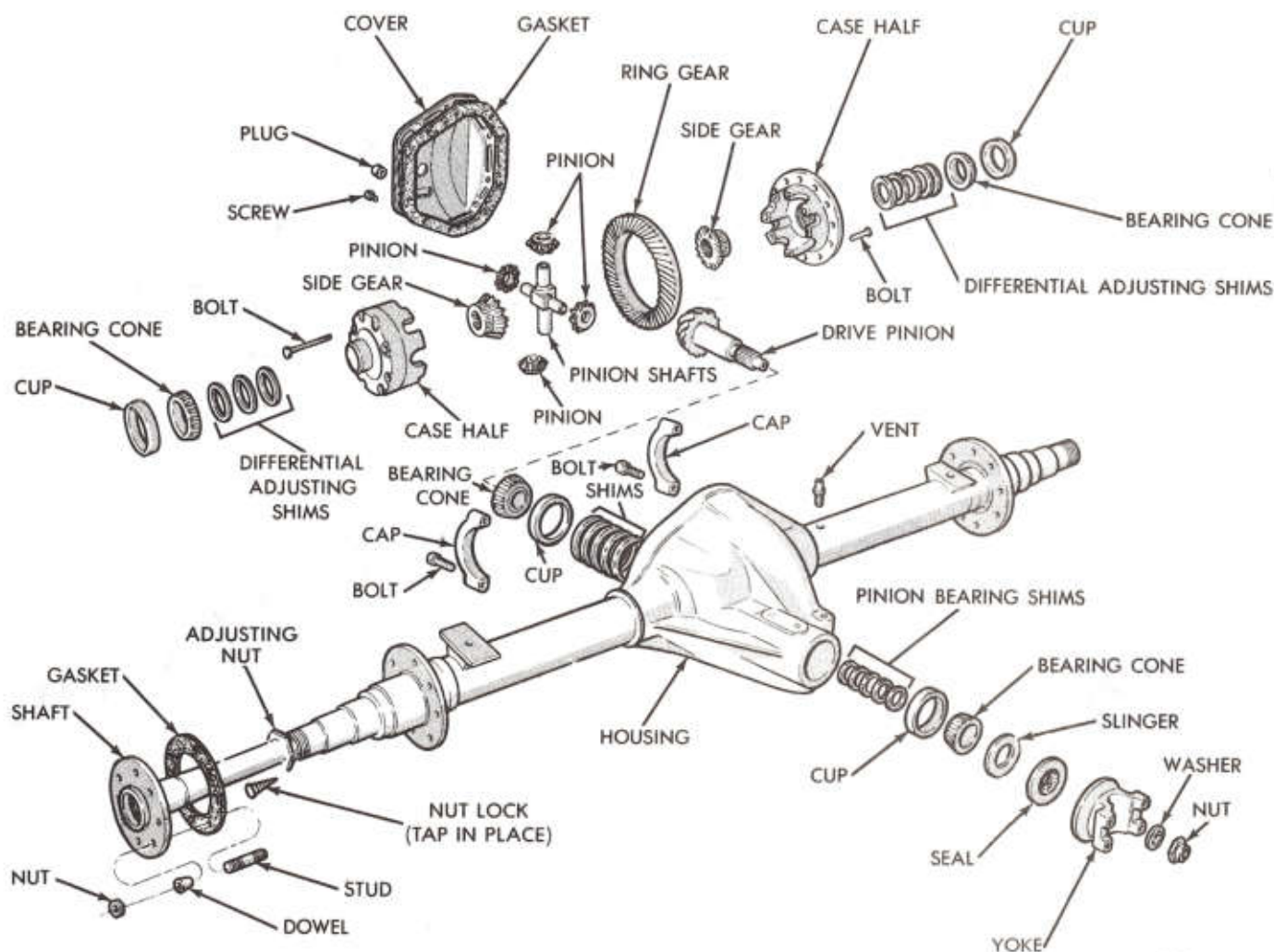
SERVICE PROCEDURES

AXLE SHAFTS

Removal and Installation

(1) Remove axle shaft flange nuts and lockwashers. Rap axle shafts sharply in center of flange with a hammer to free dowels. Remove tapered dowels and axle shafts.

(2) Clean gasket contact area with a suitable solvent install a new flange gasket and slide axle shaft into axle housing. Install tapered dowels and nuts or Durlock bolts (if so equipped). Tighten 7/16x20 nuts to 40-70 ft. lbs. (54-95 N·m), 1/2x20 nuts to 65-105 ft. lbs. (88-142 N·m) or Durlock bolts to 60 ft. lbs. (81 N·m).



RH444 A

Fig. 2—70 Rear Axle Assembly

WHEEL BEARING ADJUSTING PROCEDURE

- (1) Raise vehicle and install jack stands.
- (2) Remove axle shaft.
- (3) Remove nut lock and loosen adjusting nut.
- (4) Tighten adjusting nut to 120 to 140 ft. lbs. (163 to 190 N·m) while rotating wheel.
- (5) Back off adjusting nut 1/3 turn (120°) to obtain .001 to .008 inch end play.
- (6) Tap nut lock into spindle keyway.
- (7) Install new gasket and axle shaft.
- (8) Remove stands and lower vehicle.

REAR AXLE ASSEMBLY

Removal

Should it become necessary to remove rear axle assembly, proceed as follows:

- (1) Raise rear of vehicle until rear wheels clear floor. Support body at front of rear springs.
- (2) Block brake pedal in the "up" position using a wooden block.

- (3) Remove axle shafts, wheels and hub and drum assemblies.

- (4) Disconnect hydraulic brake line at flexible line and cap fitting to prevent loss of brake fluid.

- (5) Disconnect parking brake cables.

To maintain proper drive line balance when reassembling, make scribe marks on the propeller shaft universal joint and the pinion flange before removal.

- (6) Disconnect propeller shaft at differential pinion flange and secure in an upright position to prevent damage to front universal joint.

- (7) Remove shock absorbers and loosen rear spring U-bolt nuts and remove U-bolts.

- (8) Remove axle assembly from vehicle.

Installation

- (1) Making sure the gasket surfaces of both the cover and carrier housing are clean, install a new gasket followed by the cover and tighten the cover bolts to 30-40 ft. lbs. (41 to 54 N·m). Beneath one of the cover bolts, install the ratio identification tag.

- (2) With body supported at front of rear springs,

position rear axle assembly.

(3) Install spring U-bolts and tighten nuts to 150-210 ft. lbs. (203-285 N-m) and install shock absorbers. Tighten nuts to 35-65 ft. lbs. (47-88 N-m).

(4) Connect parking brake cables.

(5) Connect hydraulic brake line at flexible line, install hub and drum assemblies. Adjust bearings see "Wheel Bearing Adjusting Procedure".

(6) Remove block from brake pedal, adjust and bleed brakes.

(7) Install rear universal joint of propeller shaft in same position as removed (match scribe marks on propeller shaft universal joint and pinion flange). Tighten universal joint clamps to 170-200 in. lbs. (19-23 N-m).

(8) Install rear wheels and tighten nuts in the proper tightening sequence. Tighten nuts to specifications (Refer to "Group 22 - Wheels and Tires").

(9) Clean gasket contact area with a suitable solvent, install a new flange gasket and slide axle shaft into axle housing. Install tapered dowels and nuts or Durlock bolts (if so equipped). Tighten 7/16 x 20 nuts to 40-70 ft. lbs. (54-95 N-m), 1/2 x 20 nuts to 65-105 ft. lbs. (88-142 N-m), or Durlock bolts to 60 ft. lbs. (81 N-m).

(10) Raise rear of vehicle and remove supports. Level vehicle and install proper grade and quantity of lubricant see "Lubrication Group 0" in this manual. Lower vehicle and road test for proper operation.

DIFFERENTIAL

It is not necessary to remove the complete axle assembly to recondition the differential.

To place differential side gears it is only necessary to remove the axle shafts, lubricant and axle cover. To replace differential side bearings it is only necessary to remove the axle shafts, lubricant, axle cover and to readjust backlash.

Removal and Disassembly

(1) Thoroughly clean the outer area of carrier and tubes with a suitable cleaning solvent and blow dry with compressed air.

(2) Loosen and remove cover screws, and remove carrier cover, drain lubricant into a container.

(3) Using a suitable cleaning solvent, wash and clean differential, bearings, gear ring and pinion and internal surfaces and blow dry with compressed air.

(4) In preparing to measure drive gear back face runout (provided no side play was found) mount a dial indicator Tool C-3339 on pilot stud (Fig. 3), and load the indicator stem slightly when plunger is at right angles to back face of drive gear.

(5) Measure drive gear back face runout by rotating drive gear several complete revolutions and reading dial indicator. Mark drive gear and differential case

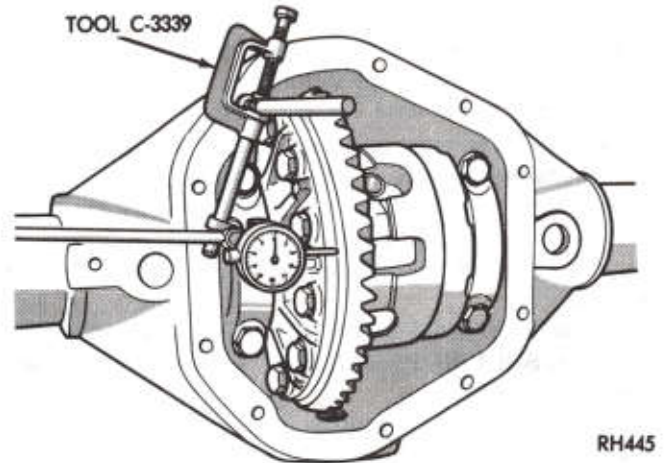


Fig. 3—Measuring Drive Gear Runout

at point of maximum runout. The marking of differential case will be very helpful later in checking differential case runout. Total indicator readings in excess of .006 inch (.15 mm) might indicate possible loose drive gear or damaged differential case. A test for differential case runout will be described later.

(6) Check the clearance between the differential bearing cap and bearing cup by trying to insert a piece of .003 inch (.08 mm) feeler stock between them. A .003 inch (.08 mm) feeler should not enter between the bearing cap and cup. A clearance of more than .003 inch (.08 mm) could be caused by bearing cup having turned in carrier, causing excessive wear.

(7) Note identifying letters stamped on bearing caps and face of carrier housing seal surface (Fig. 4). Letters stamped on left side are in horizontal position while right side are in vertical position. Always match identifying letters for proper reassembly.

(8) Loosen and remove the differential bearing caps

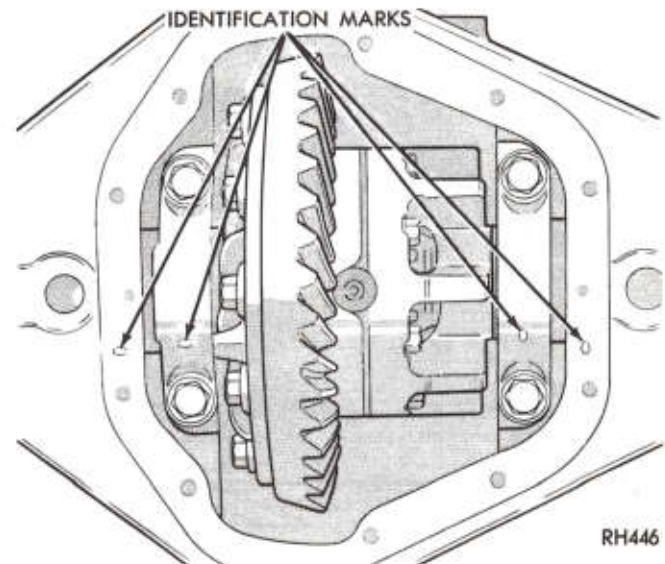


Fig. 4—Bearing Cap Identification

and locate spreader, Tool D-167 with tool dowel pins seated in locating holes of axle housing. Turn tool screw finger tight at the same time.

(9) Install pilot stud on left side of axle housing. Attach dial indicator and load indicator stem slightly against opposite sides of axle housing (Fig. 5).

(10) Tighten spreader tool nut sufficiently to obtain .015 inch (.38 mm) movement of dial indicator to permit removal of differential case and ring gear assembly.

DO NOT SPREAD OVER .015 INCH (.38 mm) AS IT WILL RESULT IN PERMANENT DAMAGE TO CARRIER CASTING.

(11) Remove dial indicator and remove differential case and ring gear assembly from axle housing. A light prying action with a screwdriver or pinch bar will loosen assembly for easy removal. Pry up differential case and ring gear as straight up as possible using leverage against differential case and carrier to prevent damage. Keep respective bearing cups with bearing cones, if they are not worn or damaged and are to be reassembled.

(12) Place the differential case between the soft jaws of a vise and remove and **DISCARD** the drive gear screws. Using a fiber mallet, tap the drive gear loose from the differential case pilot and remove.

(13) If the drive gear runout exceeded .006 inch (.15 mm) in step 5 differential case flange runout should be remeasured. Install differential case with respective bearing cups into axle housing. Loosen nut of spreader tool and remove. Install bearing caps and tighten snugly. Mount dial indicator in contact with flange face of differential case (Fig. 6), and measure runout as described in Step 5. Total allowable runout should not exceed .003 inch (.08 mm). It is often possible to reduce excessive runout by positioning drive gear 180 degrees from point of maximum runout

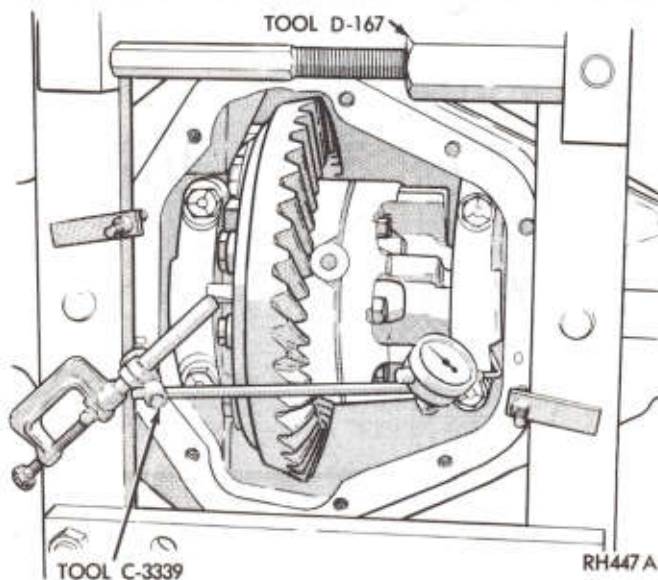


Fig. 5—Spreading Rear Axle Housing

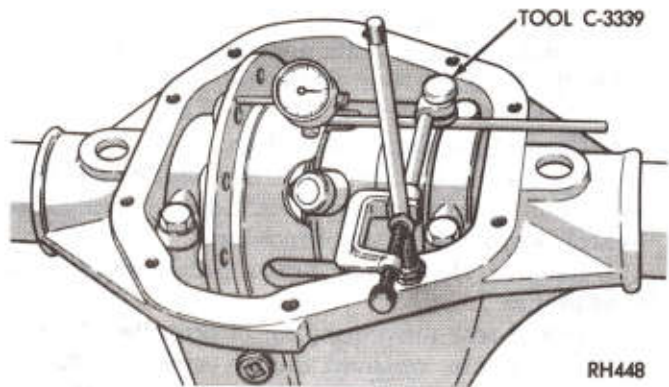


Fig. 6—Measuring Differential Case Drive Gear Mounting Flange Face Runout

when reassembling ring gear on differential case. Repeat steps 8, 9, 10 and 11 above.

(14) Remove drive pinion nut and washer. Using Tool C-452 and holding Tool C-3281, remove drive pinion yoke.

(15) Using Tool C-748, remove drive pinion oil seal. Remove slinger, front pinion bearing cone and preload shim pack. Record the thickness of the shims in case they should be lost.

(16) Position carrier and tube assembly on an arbor press, then press out the drive pinion stem and rear bearing cone assembly.

(17) Using Tool D-158 and Handle C-4171, remove front pinion bearing cup. Remove rear pinion bearing cup on the **60 and 60M axles** using Tool D-162 and Handle C-4171. Use Tool D-159 with Handle C-4171 on the **70 axle**. Remove and record thickness of shim pack from behind rear pinion bearing cup.

(18) Remove rear bearing cone from drive pinion stem using Tool DD-914-P, adapter ring DD-914-9, and adapters C-293-37 on the **60 and 60M axles** and DD-914-95 adapters for the **70 axles**.

(19) **On 60 and 60M axles** place differential case in a vise equipped with soft jaws. Drive out lock pin securing differential pinion shaft to case (Fig. 7).

On 70 axles mark differential case halves (Fig. 8) to aid at reassembly. Remove studs holding differential

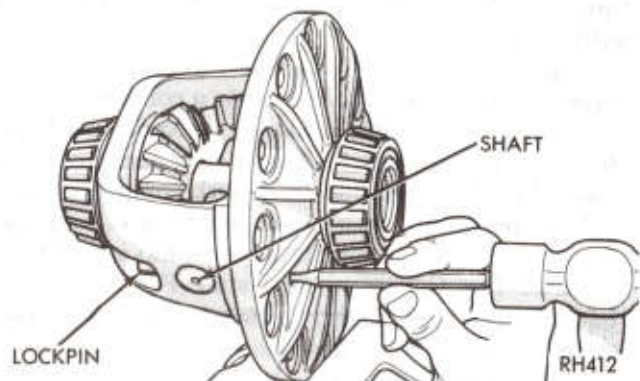


Fig. 7—Removing Differential Pinion Shaft Lock Pin (60 and 60M Axles)

case halves together. Separate case halves.

(20) Remove differential pinion mate shaft, differential pinion mates and thrust washers (one back of each pinion). Remove differential side gears and thrust washers (one back of each gear).

(21) Using Tool DD-914-P, adapter ring DD-914-8, plates DD-914-62, screw extension DD-914-7, and button DD-914-42, remove differential cones from case (Fig. 9). Care must be taken to insure that bearing remover adapters are located so as not to pull on bearing cage.

(22) Remove the shims located behind each bearing and record thickness and respective side to aid in reassembly.

Cleaning and Inspection

(1) Wash and clean all parts in a suitable cleaning solvent and with the exception of bearing cones, dry with compressed air. To clean axle housing tubes, insert a stiff wire into tube, attach a clean cloth to wire at center section and withdraw from center outward. Do not steam clean. Figures 10 and 11 show a disassembled view of the differential assembly.

(2) All machined contact surfaces in the axle housing and differential bearing caps should be smooth and free of any raised edges. Outer and inner pinion bearing cup bore machine surfaces should be smooth. Raised metal on shoulders of bores incurred in removal of cups should be removed with a hand stone.

(3) Differential bearings and front and rear pinion bearing cone and cup assemblies should have a smooth appearance with no broken or dented surfaces on rollers or roller contact surfaces. The bearing roller retainer cages must not be distorted or cracked. **When replacing bearings, always replace the cup and cone in a set only.**

(4) Examine differential pinion mate shaft, pinion mates, side gears, thrust washers and differential case for wear or damage, replace all defective parts. **Pinion**

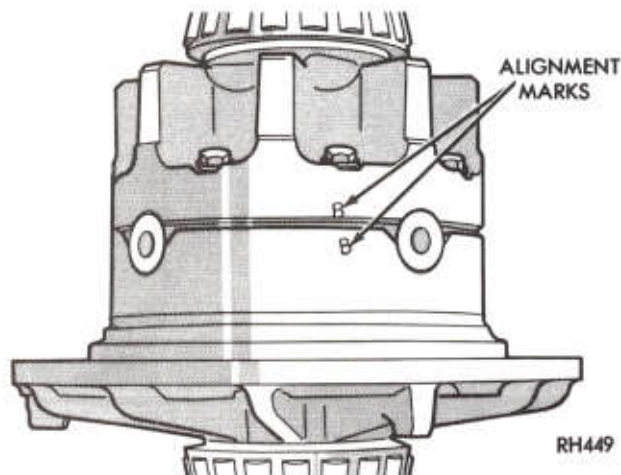


Fig. 8—Differential Case Half Identification (70 Axles)

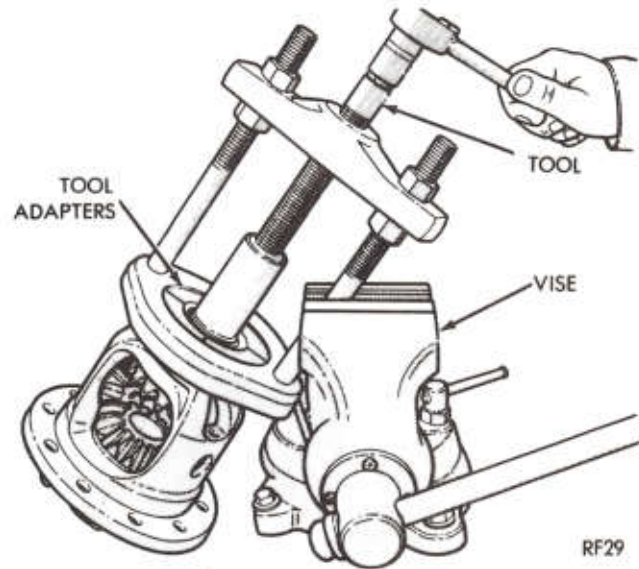


Fig. 9—Removing Differential Bearing Cone

mates should be replaced in sets. Do not replace one mate only.

(5) Inspect drive gear and pinion for worn or chipped teeth or damaged attaching bolt threads. If replacement is necessary, replace both the drive gear and drive pinion as they are available in matched sets only.

(6) Inspect universal joint flange for cracks, worn splines, pitted, rough or corroded oil seal contacting surface. Repair or replace universal joint flange as necessary.

(7) Inspect drive pinion bearing shim pack for broken, damaged or distorted shims. Replace, if necessary, during establishment of pinion bearing preload.

Assembly and Installation

(1) Lubricate all parts with differential lubricant. Install differential side gears and thrust washers, pinion mates and thrust washers and pinion mate shaft in differential case. On **60 and 60M axles** align hole in shaft with hole in case and drive in lock pin. On the **70 axle** align marks (Fig. 8) on case halves made at disassembly, install mounting studs and tighten evenly to 65-70 ft. lbs. (88 to 95 N-m). **If new gears and washers are used, it will not be necessary to check gear backlash. Correct fit is provided due to close manufacturing tolerances.** Position drive gear on differential case pilot, aligning threaded holes of drive gear with those in differential case flange.

(2) Insert new drive gear screws through case flange and into the drive gear. After all cap screws are properly started, tap drive gear against differential case flange with a non-metallic mallet.

(3) Clamp unit between brass jaws of a vise and alternately tighten each cap screw to specifications.

(4) Install master differential bearings Tool D-117 onto case (Fig. 12).

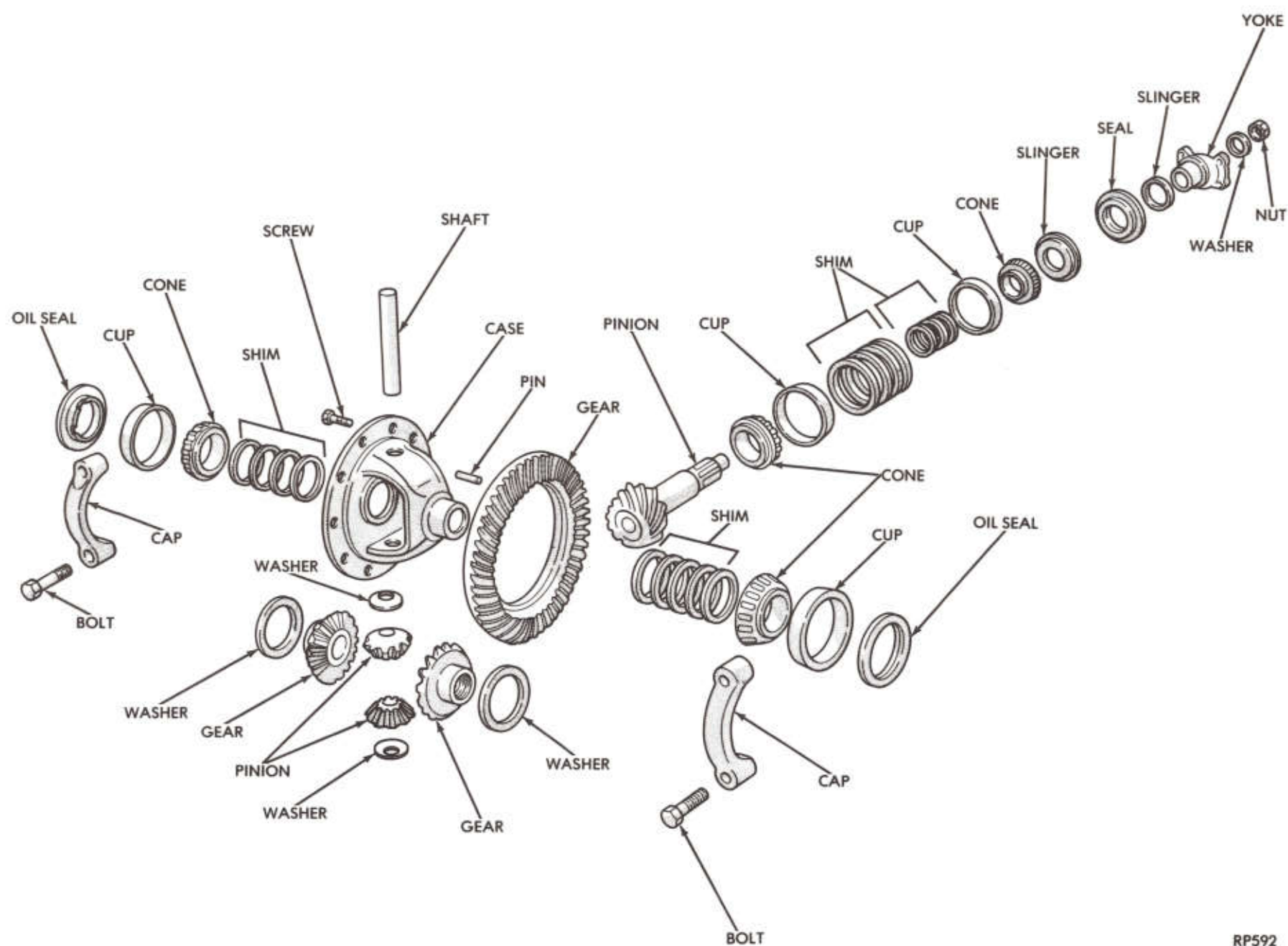


Fig. 10—Differential Assembly (60 and 60M Model Axles)

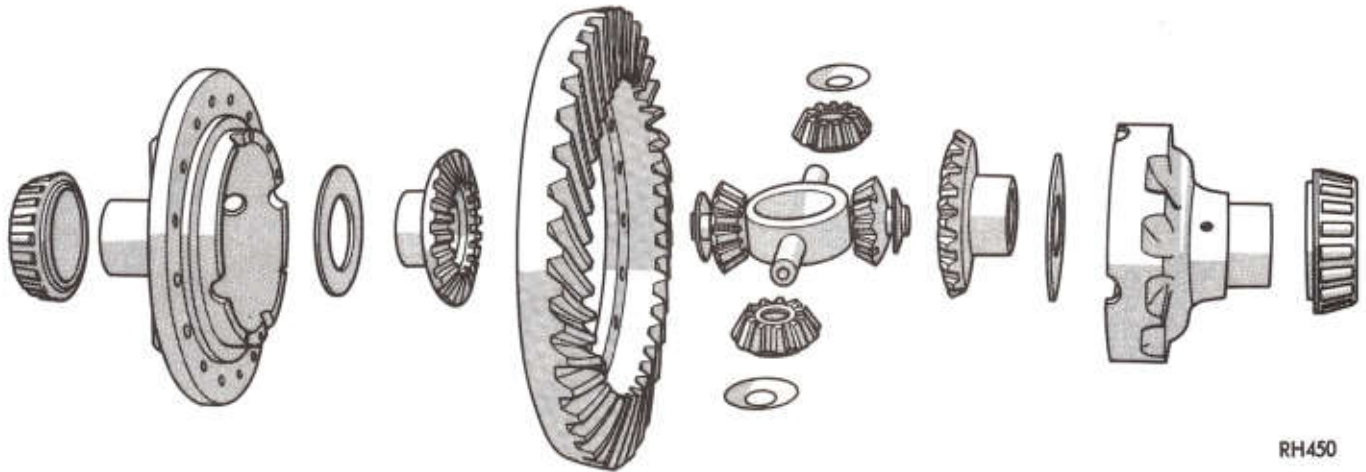


Fig. 11—Differential Assembly (70 Model Axles)

(5) Insert differential case in carrier. Install bearing caps in their correct positions and tighten bearing cap bolts finger tight.

(6) Install dial indicator fixture with indicator pointer contacting back face of drive gear.

(7) Insert a screwdriver blade between bearing cup and housing and pry case assembly as far as possible to one side of housing (Fig. 13). Set dial indicator at zero. Using screwdriver, pry case to opposite side of housing and record the reading.

This reading indicates the amount of shims needed to take up the clearance between the differential bearing cups and the case. The shim pack thickness to be placed on bearing hub between bearing cone and differential case will be calculated later in the procedure after installation of drive

pinion and depth of mesh setting.

(8) Remove dial indicator, loosen bearing cap bolts and remove bearing caps. Remove differential assembly from housing.

DRIVE PINION DEPTH OF MESH SETTING

(Using Pinion Depth Gauge Tool Set D-271)

Ring gears and pinions are supplied in matched sets only. Matching numbers on both the pinion and ring gear are etched for verification.

On the face of each pinion there is etched either a plus (+) number, or a minus (-) number, or "0" which indicates the best running position for each particular gear set. This dimension is controlled by

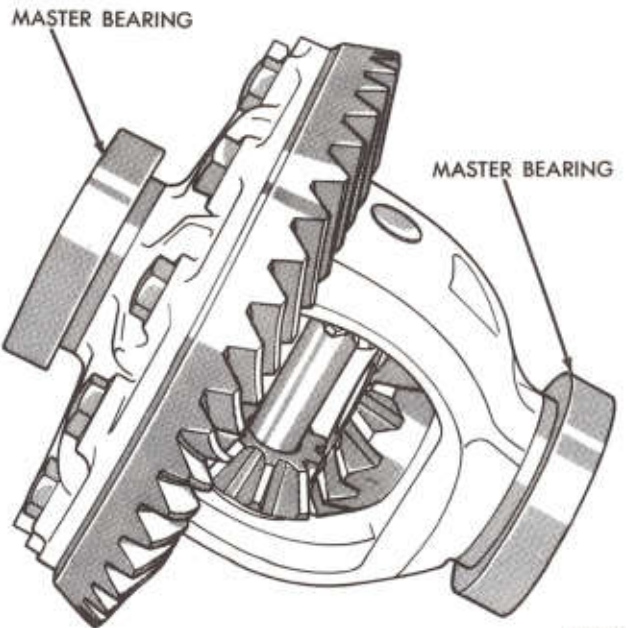


Fig. 12—Differential Master Bearing Installed

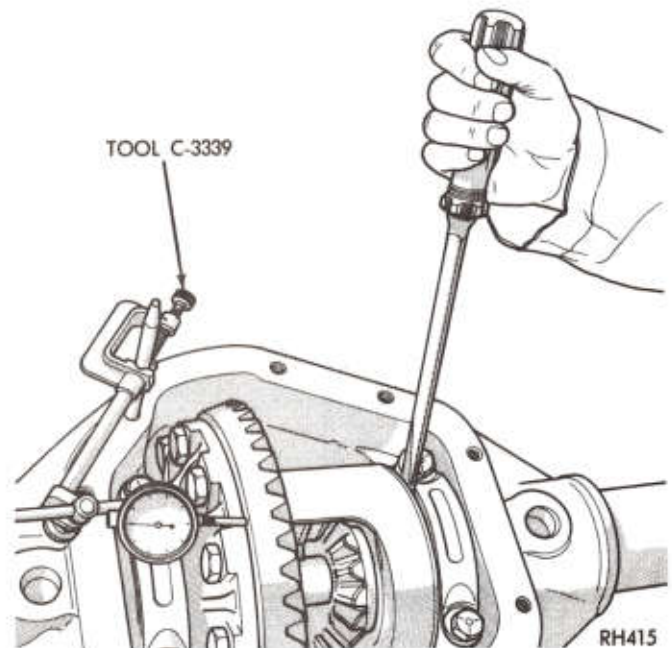


Fig. 13—Determining Shims to Obtain "0" End Clearance

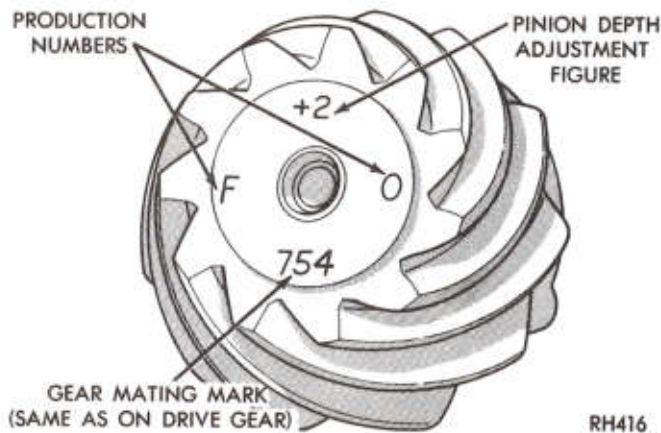


Fig. 14—Drive Pinion Markings

shimming behind the inner pinion bearing cup (Fig. 14).

The distance from the centerline of the ring gear to the face of the pinion is as shown in Figure 15.

If the etched figure is "0" the shim pack will remain unchanged. "See Pinion Setting Chart."

For Example—if a pinion is etched +3 (m+8) this pinion would require .003" (.08 mm) less shims than a pinion etched "0". By removing shims, the mounting distance of the pinion is increased to 3.503" (88.98 mm), which is what a +3 (m+8) indicates. Or if a pinion is etched -3 (m-8) we must add .003" (.08 mm) more shims than would be required if the pinion were etched "0". By adding .003" (.08 mm) shims the mounting distance of the pinion is decreased to 3.497" (88.82 mm) which is what a -3 (m-8) indicates.

If a new gear set is being used, notice the (+) or (-) etching on both the old and new pinion and adjust the thickness of the new shim pack to compensate for the difference of these two figures.

For example—If the old pinion reads (+) 2 (m+5) and the new pinion is (-) 2 (m-5), add .004" (.10 mm) shims to the original shim pack.

If the old ring and pinion set is to be reused,

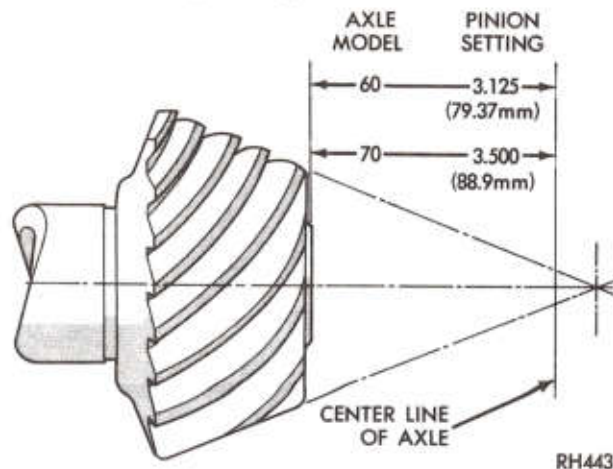


Fig. 15—Pinion Setting Dimension

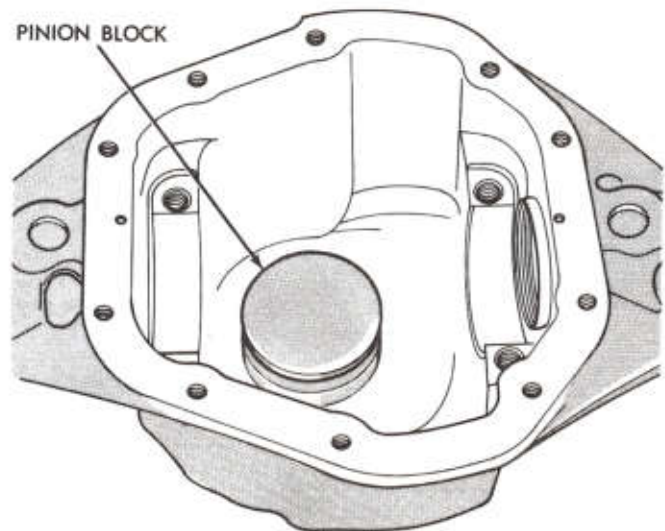


Fig. 16—Master Pinion Block Installed in Pinion Bore

measure the old shim pack and build a new shim pack to this same dimension. If a baffle is used in the axle assembly, its thickness is considered as part of the shim pack. Shims are available in thicknesses of .003", .005", .010", and .030" (.08, .13, .25, and .76 mm).

(1) Place master pinion block into the pinion bore of the carrier (Fig. 16), Tool D-120 for **60 and 60M axles**, and Tool D-137 for the **70 axle**.

(2) Mount arbor discs Tool D-116-2 on arbor Tool D-115-3 and install into cross bores of carrier (Fig. 17).

(3) Place pinion height block Tool D-116-1 on top of master pinion block and against arbor (Fig. 18).

(4) Position gage assembly, Tool D-115-2 gage block and D-106-5 dial indicator, on small step of pinion height block. Making sure that the gage assembly is

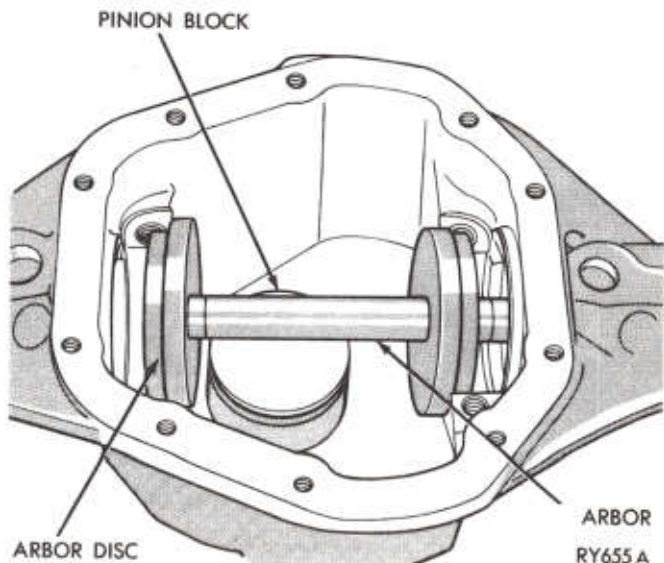


Fig. 17—Arbor Discs and Arbor in Position

PINION SETTING CHARTS (U.S. AND METRIC)

By utilizing these specifications, proper gear contact should be established.

Old Pinion Marking	New Pinion Marking (U.S. Standards)								
	-4	-3	-2	-1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003
0	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004
-1	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005
-2	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006
-3	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007
-4	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007	-0.008

Old Pinion Marking	New Pinion Marking (Metric)								
	-10	-8	-5	-3	0	+3	+5	+8	+10
+10	+20	+18	+15	+13	+10	+08	+05	+03	0
+8	+18	+15	+13	+10	+08	+05	+03	0	-.03
+5	+15	+13	+10	+08	+05	+03	0	-.03	-.05
+3	+13	+10	+08	+05	+03	0	-.03	-.05	-.08
0	+10	+08	+05	+03	0	-.03	-.05	-.08	-.10
-3	+08	+05	+03	0	-.03	-.05	-.08	-.10	-.13
-5	+05	+03	0	-.03	-.05	-.08	-.10	-.13	-.15
-8	+03	0	-.03	-.05	-.08	-.10	-.13	-.15	-.18
-10	0	-.03	-.05	-.08	-.10	-.13	-.15	-.18	-.20

flat on the pinion height block, set the dial indicator to read "0" (Fig. 19).

(5) With indicator set at "0", move the gage assembly so that the tip of the dial indicator stem contacts the arbor. Move the gage assembly back and forth to obtain the indicator reading at the highest point of contact.

This reading, plus or minus the value of the etched figure on the face of the pinion is the required thickness of the pinion bearing shim pack.

(6) Measure each shim separately with a micrometer and add together to get total shim pack thickness. If baffle is required, its thickness is to be included in the shim pack. If slinger is used between the inner bearing cone and thrust face of pinion, the slinger thickness is also to be measured and included as part of the total shim pack.

Place the required amount of shims (and baffle if used) in the inner bearing bore; drive the inner bearing cup into the carrier, use Tool D-111 for 60 and

PINION HEIGHT
BLOCK D-116-1

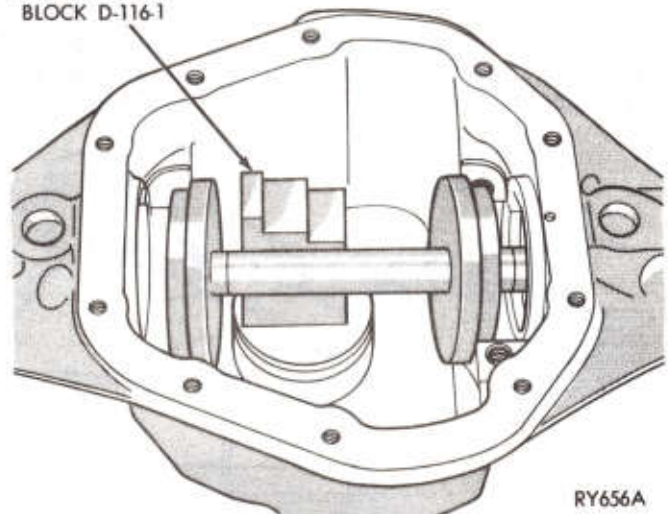


Fig. 18—Pinion Height Block Positioned Against Arbor

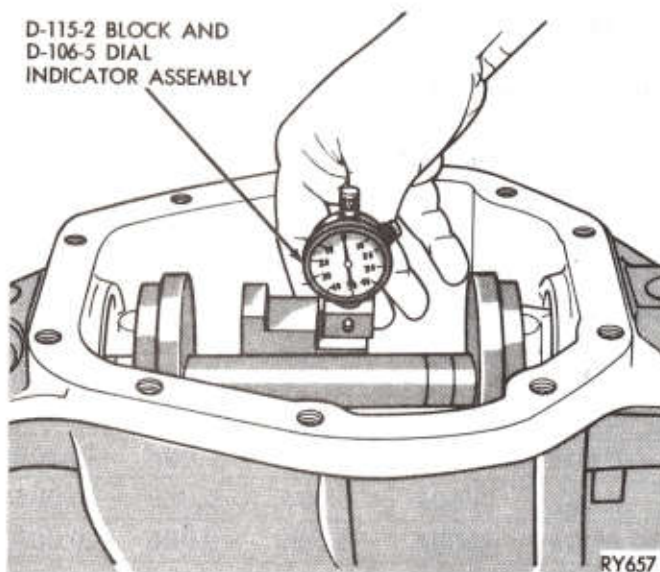


Fig. 19—Checking Pinion Depth

60M axles and Tool C-4204 for the 70 axle and C-4171 handle. Make sure cup is seated.

Pinion Bearing Preload

(1) Using Tool C-4203 and Tool C-4171 drive the outer pinion bearing cup into the carrier (Fig. 20).

(2) Drive or press inner bearing onto shaft until it is completely sealed using Tool C-3095-A (Fig. 21).

(3) Install pinion into carrier followed by the outer pinion bearing cone, (baffle if used), end yoke, washer and nut. Use yoke installing Tool C-3718 and Tool C-3281 (Fig. 22).

Do not assemble preload shims or pinion oil seal at this time.

(4) Using inch pound torque wrench, tighten yoke nut until it requires 10 in. lbs. (1.13 N·m) to rotate pinion (Fig. 23).

(5) Recheck pinion depth at this time by placing arbor and discs (small diameter discs for Model 60 axles and large diameter used on Model 70 axle) into cross bore of carrier. Place pinion height block on face

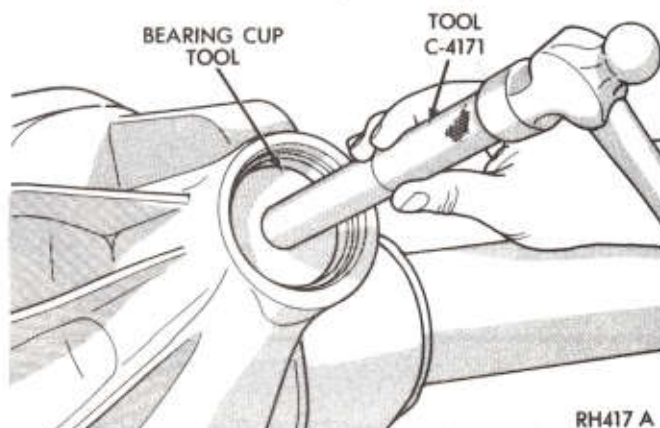


Fig. 20—Installing Outer Pinion Bearing Cup

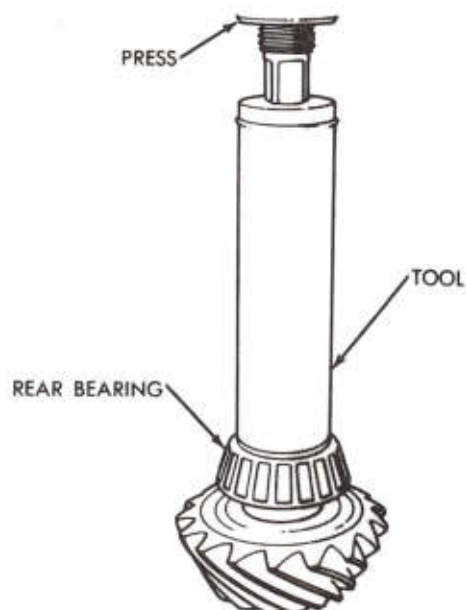


Fig. 21—Installing Pinion Bearing Cone

of pinion. Set dial indicator on small step of height block. (High step of block is used for Model 70 axle). Set dial indicator at "0". Slide gage assembly across or over arbor. See Fig. 19.

Indicator will read a plus (+) or minus (−) at its highest point, depending on the etched figure on the pinion.

Indicator reading within .002 (.05 mm) of etching is considered acceptable. If pinion position is found to be within specifications continue with build up. If pinion position is not within specifications change shim pack thickness under inner bearing cup.

(6) Remove pinion nut, washer, end yoke, slinger, and bearing cone. Assemble preload shims (which were removed during disassembly) onto pinion. As-

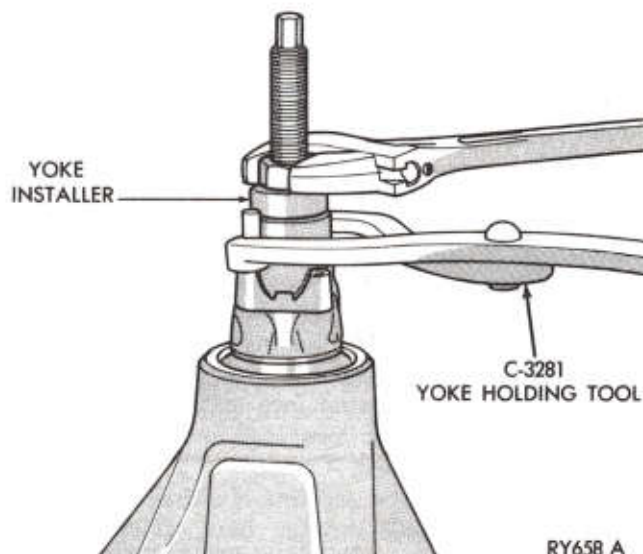


Fig. 22—Installing Pinion and Yoke

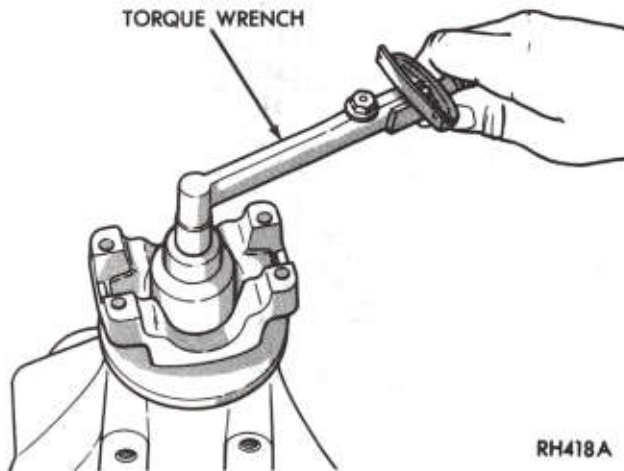


Fig. 23—Rotating Pinion to Seat Bearings

semble bearing cone, and slinger.

Apply a light coat of hypoid lubricant on the lip of pinion seal and assemble into carrier using seal installing Tool C-3719 and C-4171 handle for **Model 60** axles and for **Model 70** axle use Tool C-359 (Fig. 24).

(7) Assemble end yoke, washer, and new pinion nut. Tighten to 250-270 ft. lbs. (339-366 N·m).

(8) Using an inch pound torque wrench as shown rotate pinion. Torque required to rotate pinion should read between 20-40 in. lbs. (2.26-4.53 N·m). To increase preload, remove shims; to decrease preload add shims.

The illustration in Figure 25 shows the arrow in the pinion pointing in two directions. The direction pointing towards the end yoke indicates that by removing pinion position shims, the distance from the centerline of the axle to pinion face is increased giving a

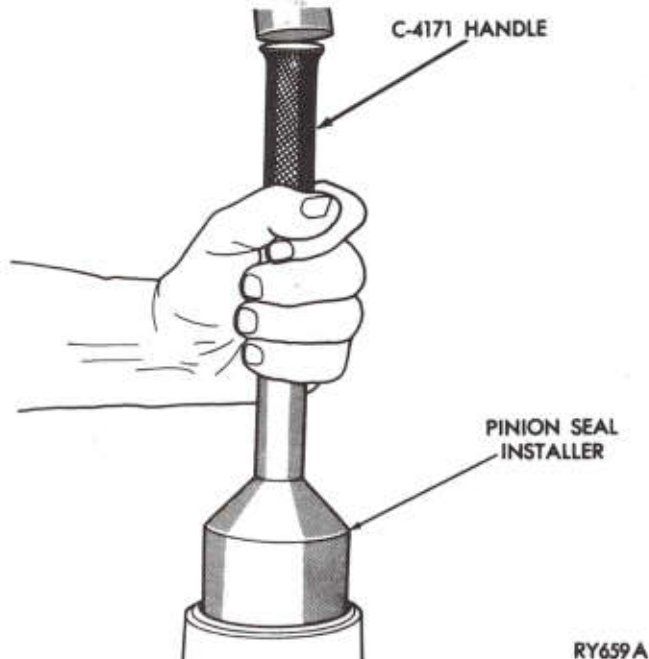


Fig. 24—Installing Pinion Seal

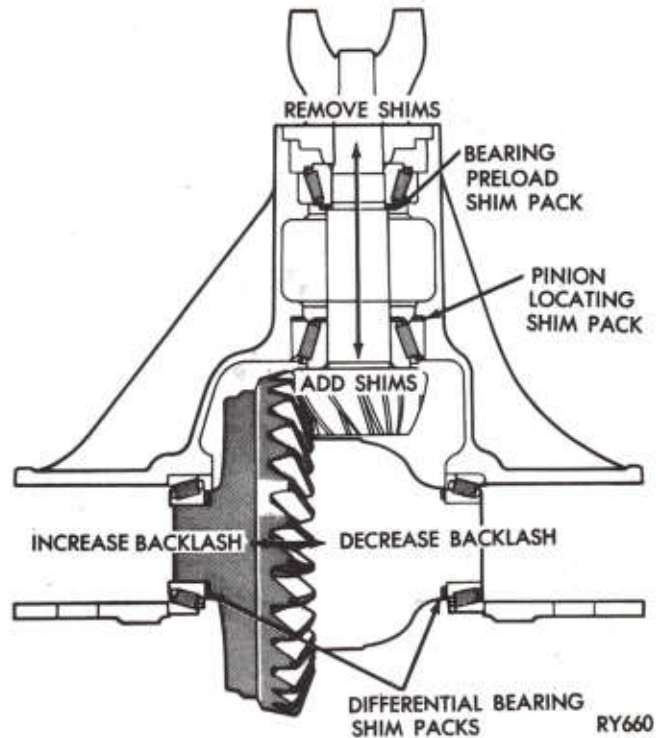


Fig. 25—Use of Shims to Adjust Gear Tooth Contact

plus reading. The preload shim pack does not effect the pinion depth setting. Arrows on the ring gear illustrate the method required to increase or decrease backlash and differential bearing preload.

(9) With master bearing Tool D-117 installed on the differential case, place assembly into housing.

(10) Set up dial indicator as shown in (Fig. 13). Press ring gear into mesh with the pinion. Rock ring gear to allow the teeth of the gears to mesh. With



Fig. 26—Seating Bearing Cone

pressure still applied to the differential case, set indicator at "0".

(11) Press the differential case (ring gear) away from the pinion gear to obtain an indicator reading. Repeat until the same reading is obtained each time. This reading will represent the necessary amount of shims required between the differential case and differential bearing on the ring gear side. Remove indicator and differential case from the carrier. Remove differential from case, remove master bearings.

(12) Assemble the required amount of shims onto hub (ring gear side) as determined. Place bearing cone on hub of case. Use bearing installer Tool C-4025A and C-4171 handle, seat bearing cone (Fig. 26).

(13) Assemble the remaining of the total shim pack which was determined in step 7, assembly and installation, on the opposite side of the differential case. Add an additional .015" (.38 mm) of shims on this side to compensate for differential bearing preload. Assemble differential bearing using Tool C-4025-A and C-4171 handle.

(14) Install spreader and indicator to carrier and spread housing.

Do not spread over .020 (.51 mm). Remove indicator.

(15) Assemble differential bearing cups to differential bearing cones.

Install differential assembly into carrier.

(16) Install bearing caps. Make sure the letters stamped on the caps correspond with those on the carriers. Tighten bearing cap screws to 80-90 ft. lbs. (108-122 N·m). (Fig. 27).

(17) Check ring gear and pinion backlash in three equally spaced points with dial indicator as shown in (Fig. 28).

Backlash tolerance is .004" (.10-23 mm) to .009" and cannot vary more than .002" (.05 mm) between points checked.

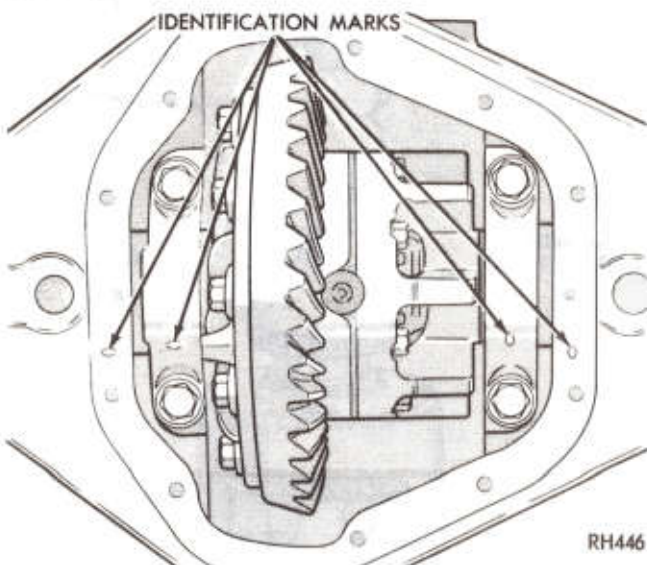


Fig. 27—Differential Installed in Carrier

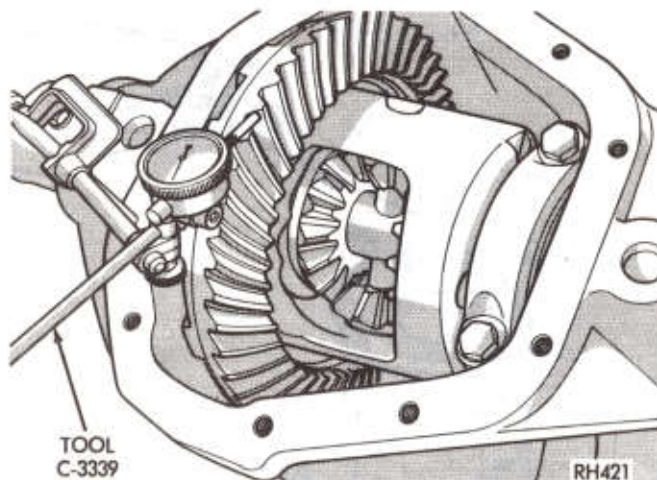


Fig. 28—Checking Ring and Pinion Gear Backlash

High backlash is corrected by moving the ring gear closer to the pinion.

Low backlash is corrected by moving ring gear away from the pinion.

These corrections are made by switching shims from one side of the differential case to the other. (Fig. 25).

(18) Install new cover gasket and install cover plate. Tighten screws to 30-40 ft. lbs. (41-54 N·m).

DRIVE PINION DEPTH OF MESH

(Using Tool C-758-D6)

Rear axle setting gauge Tool C-758-D6 is used to install drive pinion bearing cups as well as to determine pinion depth of mesh.

(1) Start both drive pinion bearing cups into axle housing.

(2) Assemble Tool C-758-D6 by positioning locating spacer SP-5184 for **Model 60 axles** and SP-5587 for **Model 70 axles** on main screw of tool. Position rear pinion bearing cone on tool screw and insert into axle housing.

(3) Position front pinion bearing cone over main screw of tool followed by compression sleeve SP-535-A, centralizing washer SP-534, and main screw nut SP-533.

(4) Lubricate drive pinion bearing cones with rear axle lubricant.

(5) To install pinion bearing cups, hold compression sleeve from turning with Tool C-3281, tighten nut, thereby drawing pinion bearing cups into axle housing bearing cup bores. Permit tool to turn several revolutions during tightening operation to permit bearing rollers to align and prevent brinnelling of bearing cups. **Do not remove tool after installing cups. Pinion depth of mesh will be determined next.**

(6) With main tool left in axle housing after installing drive pinion bearing cups, loosen tool nut and retighten nut to produce 10-30 in. lbs. (1-3 N·m) of

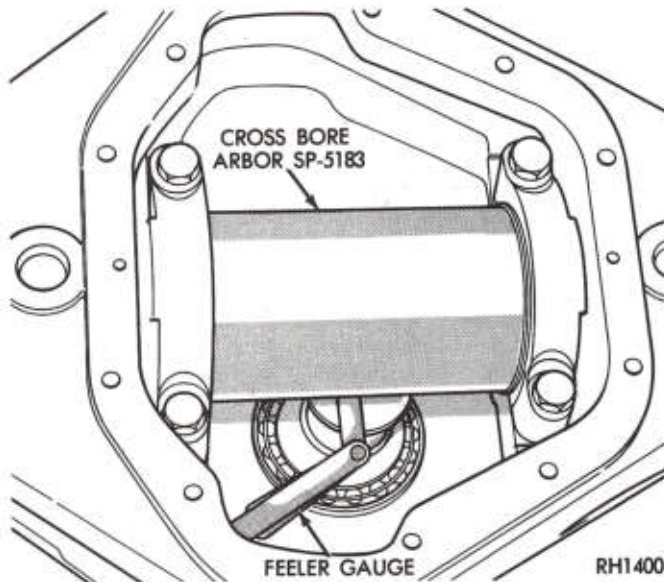


Fig. 29—Determining Shim Pack Thickness for Drive Pinion Depth of Mesh

preload. Rotate while tightening to align bearing rollers.

(7) Install gauge block SP-5260 on main tool and tighten screw with an Allen wrench securely.

(8) Position cross bore arbor SP-5183 in axle housing in differential bearing seats. Center the arbor so that an approximate equal distance is maintained at both ends. Correctly position differential bearing caps and insert bolts and tighten to 10 ft. lbs. (14 N·m).

(9) Using a feeler gauge select the proper thickness of shims that will snugly fit between arbor and gauge block. This fit must be snug but not too tight (similar to the pull of a feeler gauge). This measurement is then used in determining the correct thickness shim pack for installation behind the rear pinion bearing cup and carrier casting (Fig. 29).

(10) To select a shim pack for installation, read the markings on the end of pinion head (-0, -1, -2, +1, +2, etc.). When marking is -(minus), add that amount to the thickness of shim pack selected in step (9). When the marking is +(plus), subtract that amount. Treat other pinion markings in a similar manner. Shims are available in .003, .005, and .010 inch (.08, .13, and .25mm) thickness. See, "Pinion Setting Chart".

(11) Remove the tool arbor and tool from axle housing.

(12) Using a brass drift or soft punch and hammer remove rear pinion bearing cup from casting.

(13) Position the correct shim pack in axle housing cup bore and install rear bearing cup as described previously in steps (1 thru 5). When cup is properly seated, remove tool and pinion bearing cones.

PINION BEARING PRELOAD

(1) Lubricate rear drive pinion bearing cone with

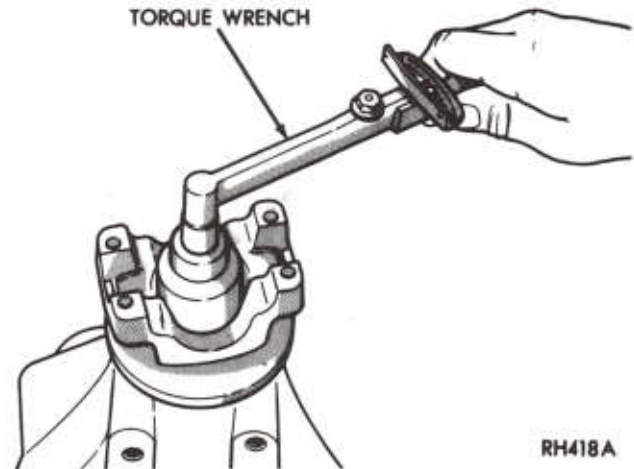


Fig. 30—Checking Pinion Bearing Preload

rear axle lubricant, and install bearing cone on pinion stem using Tool C-3095. An arbor press may be used in conjunction with tool.

(2) Install drive pinion and bearing assembly in carrier and install the original front pinion bearing shim pack followed by the bearing cone. **Do not install oil seal at this time.**

(3) Install universal joint flange, washer and nut. Tighten nut 250-270 ft. lbs. (339 to 366 N·m). Rotate pinion several complete revolutions to seat bearing rollers.

(4) Using an inch-pound torque wrench C-685-A, measure pinion bearing preload by rotating pinion with handle of wrench floating (Fig. 30). Take reading while handle is moving through several complete revolutions. Correct preload is 10-20 in. lbs. (1 to 2 N·m). **Add** shim to decrease preload and **Subtract** shims to increase preload. Shims are available in the following thicknesses: .003, .005, .010, and .030 inch (.08, .13, .25, and .8 mm).

(5) After the correct pinion bearing preload has been established, remove the universal joint flange, nut and washer.

(6) Install oil slinger and gasket. Using pinion seal installing Tool C-3719 and Handle C-4171 on **60 Model axles** and on the **70 Model axles** use Tool C-359, install drive pinion oil seal.

(7) Install universal joint flange washer and nut. Tighten nut 250-270 ft. lbs. (339 to 366 N·m).

DIFFERENTIAL BEARING PRELOAD AND DRIVE GEAR AND PINION BACKLASH

(1) With drive pinion and bearings installed and bearing preload set, install differential case and ring gear assembly with their respective bearing cups. Install bearing caps in their positions, align identification marks and tighten cap bolts finger tight.

Refer to the measurement taken previously in Step (7) of "Differential—Installation."

This reading taken before the drive pinion was installed represents the total clearance between the differential bearing cups and the carrier casting. Perform the following steps to determine the thicknesses of shims required behind each bearing cone to take up the clearance and establish the correct bearing preload and backlash.

(2) Install a dial indicator and position the contact point against back face of ring gear. Move the differential and ring gear assembly tight against the drive pinion, set the dial indicator on 0. Move the differential and ring gear assembly in the opposite direction as far away from pinion as possible and note the reading on dial indicator.

This reading represents the thickness of shim pack necessary to take up the clearance between the bearing cup and the case on the ring gear side of the differential assembly. Subtract this reading from the previously recorded total reading to obtain the amount of shims necessary to take up the clearance between the bearing cup and the case at the pinion side of the differential.

(3) Remove differential and ring gear assembly from carrier.

(4) Remove differential bearing cones. Install the correct thickness shim pack as determined in step 2 between bearing cone and differential case hub shoulder using Tool C-4025-A and Handle C-4171. Add an additional .015 inch (.38mm) shims to the drive gear tooth side of differential and install the differential bearing cones. This additional .015 inch (.38mm) shim pack provides the correct bearing preload and backlash.

(5) Position spreader Tool D-167 in locating holes of carrier and tighten screw finger tight. Install dial indicator and spread carrier .015 inch. Do not exceed this limit to permit placing of differential and ring gear assembly in carrier.

(6) Install the bearing caps in their respective positions as indicated by identification marks on caps and carrier. Remove the spreader tool. Coat the bearing cap bolt threads with sealing compound and install and tighten bolts snugly.

(7) Tap the drive gear lightly with a rawhide hammer to properly seat the differential bearing and cups. **Care must be taken in this operation to prevent nicking the teeth of ring gear or drive pinion as they are meshed together.** Tighten the bearing cap bolts to 85-90 ft. lbs. (115-122 N·m).

(8) Attach a dial indicator to carrier and with indicator contact point contacting ring gear tooth (Fig. 28), measure the backlash between the ring gear and drive pinion.

(9) Check backlash at four equally spaced points around circumference of ring gear. Backlash must be held between .004-.009 inch and cannot vary more than .002 inch between the four positions checked.

If backlash does not fall within these specifications, change shim pack thickness on both differential bearing hubs to maintain proper bearing preload and backlash. Service Packages for shims are available.

GEAR TOOTH CONTACT PATTERN

Gear tooth contact will be correct if all preceding procedures have been followed.

LUBRICATION

In these Differentials, use only the MOPAR Hypoid Lubricant Part Number 4318058 or equivalent.

Should the rear axle become submerged in water, the lubricant must be changed immediately to avoid the possibility of early axle failure resulting from contamination of the lubricant by water.

REAR AXLE ASSEMBLY SPICER 60 (TRAC-LOK DIFFERENTIAL)

INDEX

	Page
Differential Case	39
Assembly	40
Cleaning and Inspection	39
Installation	40
Removal	39
Differential Noise	39

	Page
General Information	38
Lubrication	40
Service Diagnosis	1
Service Procedures	39
Testing Differential	39

GENERAL INFORMATION

CAUTION: Anytime rear axle servicing is necessary, or axle is being rotated through use of the engine or other means, **ELEVATE BOTH REAR WHEELS.**

This rear axle is of the integral carrier-housing, hypoid gear type in which the centerline of the drive

pinion is mounted below the centerline of the ring gear.

The rear axle housing is an iron casting with tubular legs pressed into and welded to the carrier to form a carrier and tube assembly. A removable

stamped steel cover is bolted to the rear of the carrier to permit visual inspection of the differential without removing the complete rear axle from the vehicle.

A small metal tag is attached beneath one of the cover screws to identify the axle ratio. This tag is stamped with the number of teeth on the drive pinion and ring gear and the axle ratio.

The differential in this rear axle assembly has a one-piece case and two pinions. It is not a locking differential. Torque from the ring gear is transmitted through clutch packs between the side gears and

differential case. The multiple disc clutches with radial grooves on the plates and concentric grooves on the discs are engaged by a preload from Belleville springs, plus separating forces from the side gears, as torque is applied through the ring gear. In normal driving conditions the controlled internal friction is easily overcome during cornering so that the driving wheels can turn at different speeds. Extreme differences in traction conditions at the driving wheels may permit one wheel to spin.

SERVICE PROCEDURES

Service procedures for the **Trac-Lok** differentials are basically the same as previously covered in the conventional section of this group, therefore only the differences will be covered here.

DIFFERENTIAL NOISE (CHATTER MOAN)

It is suggested that before the axle assembly is disassembled for any type noise complaint, that the lubricant be changed. An improper lubricant can cause such noises as chatter and moan as well as scoring of the differential clutch plates and discs resulting in a possible failure of the unit.

(1) With lubricant of rear axle assembly at operating temperature raise vehicle on hoist so rear wheels are free to turn.

(2) Loosen and remove drain plug and drain out as much of the old lubricant as possible.

(3) Fill to proper level with MOPAR Hypoid Lubricant Part Number 4318058 or equivalent. Reinstall fill plug and tighten.

(4) Start engine of vehicle and engage in gear run on hoist with rear wheels free to turn at approximately 40 mph (64 km/h) for 10 minutes. This thoroughly circulates the lubricant and brings it to operating temperature.

(5) Stop vehicle and remove filler plug and using a suction pump remove as much of the old lubricant as possible.

(6) Remove filler plug. Install 4 ounces of MOPAR Hypoid Gear Oil Additive Friction Modifier, Part No. 4318060 or equivalent in the axle. Refill axle to proper level with MOPAR Hypoid Lubricant, Part No. 4318058 or equivalent. Reinstall fill plug and tighten.

(7) Lower vehicle on hoist and return to customer to drive and evaluate for approximately 100 miles (160 km) to determine if lubricant corrects the noise condition.

If after driving vehicle approximately 100 miles (160 km) the differential noise is still evident, remove the differential case and internal parts. **With the exception of the ring gear and differential side**

bearings the differential case and internal parts are serviced as an assembly only and should not be disassembled.

TESTING DIFFERENTIAL

(1) Drive the vehicle to thoroughly warm up the lubricant in the rear axle.

(2) Place a piece of Kraft paper or equivalent over a smooth Formica board or equivalent. Make sure the Formica board is on a flat and level floor.

(3) Drive the vehicle over Formica board until one rear wheel is in the center of the Formica board and Kraft paper.

(4) Place a block of wood two inches high and a minimum of three inches wide in front of one of the front wheels.

(5) With a "gradual" throttle opening, attempt to slowly drive the vehicle over the block of wood.

(6) If the paper slips out from under the rear wheel before vehicle drives over the block of wood, then reposition the paper under the other rear wheel, and attempt to drive over the block of wood the second time.

(7) If the vehicle drives over the block of wood the first or second time, the axle can be considered functional and to our specifications.

DIFFERENTIAL CASE

Removal

Follow the same procedures outlined under conventional differential removal.

Cleaning and Inspection

(1) Clean the differential assembly in a fast evaporating mineral spirits or a dry cleaning solvent and with exception of bearings, dry with compressed air.

(2) Inspect differential bearing cones, cups and rollers for pitting, spalling or other visible damage. If replacement is necessary, follow procedure outlined in conventional section.

Assembly

(1) If the ring gear was removed from the differential case or is being replaced with a new ring gear for any reason, new drive gear screws must be installed.

(2) Place differential case assembly in holding fixture. Install drive gear with new bolts. Tighten bolts 100 to 120 ft. lbs. (136-203 N-m).

Installation

Follow the same procedure outlined under conventional differential installation.

LUBRICATION

Multi-Purpose Gear Lubricant, as defined by the American Petroleum Institute GL-5 should be used in all rear axles with conventional differentials; MOPAR Hypoid Lubricant, Part No. 4318058 is an oil of this type and is recommended or equivalent.

In Trac-Lok Differentials 4 ounces of MOPAR Hypoid Gear Oil Additive Friction Modifier, Part No. 4318060 or equivalent must be included with this fill.

Should the rear axle become submerged in water, the lubricant must be changed immediately to avoid the possibility of early axle failure resulting from contamination of the lubricant by water.

SPECIFICATIONS**REAR AXLE**

Truck Model Designation	D150 AD150	D150 W150 AD150 AW150	D250 W250	D250 W250 W350	D350 W350	D350
SINGLE SPEED						
Type	SFH	SFH	SFH	FFH	FFH	FFH
Capacity	3400	3600	5500	5500	7500	5800
Model	8-3/8	9-1/4	9-1/4 HD	60	70	60M
Number of Differential Pinions	2	2	2	2	2	2
Drive Gear Pitch Diameter	8.375	9.25	9.25	9.75	10.5	9.75
Number of Teeth						
Drive Gear	45	—	—	41	39	41
Pinion	14	—	—	10	8	10
Ratio to 1	3.21	—	—	4.1**	4.88**	4.10**
Number of Teeth						
Drive Gear	39	45	39	—	41	—
Pinion	11	14	11	—	9	—
Ratio to 1	3.55	3.21*	3.55*	—	4.56(1)	—
Number of Teeth						
Drive Gear	47	39	39	—	41	—
Pinion	16	11	10	—	10	—
Ratio to 1	2.94	3.55*	3.90	—	4.10(1)	—
Lubricant Capacity (Pints)	4.4	4	4	6	7	6
(Imp. Meas.)	3-1/2	3-1/4	3-1/4	5	5-3/4	5
(Litres)	2.1	1.9	1.9	2.8	3.3	3.3

(1) Not available on W350

SFH—Semi-Floating Hypoid.

FFH—Full-Floating Hypoid.

*Sure-Grip Differential Available.

**Trac-Loc Differential Available.

TIGHTENING REFERENCE

Location	Ft.-Lbs.	N-m
MODEL: 8-3/8 INCH RING GEAR		
Differential Bearing Cap Bolts	70	95
Ring Gear to Differential Case Bolts	70	95
Drive Pinion Flange Nut	210 (Min.)	285 (Min.)
Carrier Cover Bolts	35 ft. lbs.	47
Brake Support Plate Retainer Nuts	30-35	41-47
Propeller Shaft Bolts (Rear)	170-200 in. lbs.	19-23
Spring Clip (U-Bolt) Nuts	45	61
Wheel Stud Nuts	105	142
Shock Absorber Stud Nuts	50	68
MODEL: 9-1/4 INCH RING GEAR (STD. and HD)		
Brake Support Plate Retainer Nuts	35	47
Carrier Cover Bolts	35 ft. lbs.	47
Differential Bearing Cap Bolts	100	136
Drive Pinion Flange Nut	210 (Min.)	285 (Min.)
Propeller Shaft Bolts (Rear)	170-200 in. lbs.	19-23
Ring Gear To Differential Case Bolts (Left Hand Thread)	70	95
Shock Absorber Stud Nuts (Lower)	50	68
Spring Clip (U-Bolt) Nuts	65 (Min.)	88 (Min.)
Wheel Stud Nuts	105	142
MODELS: 60, 60M AND 70		
Axle Shaft Flange Nut—7/16 x 20	40-70	54-95
—1/2 x 20	65-105	88-142
Brake Support to Axle Nut	65-105	88-142
Companion Flange Nut (Pinion Nut)	250-270	339-366
Differential Bearing Cap Bolt—60, 60M	80-90	108-122
—70	85-90	115-122
Differential Case Half Bolt	65-70	88-95
Carrier Cover Bolts—60, 60M	30-40	41-54
—70	30-40	41-54
Ring Gear Cap Screws—60, 60M	110-115	149-156
—70	100-110	136-149
Shock Absorber Mounting Nuts	35-65	47-88
Spring U-Bolt Nuts	150-210	203-285
Universal Joint Clamp Cap Screws	170-200 in. lbs.	19-23
Wheel Mounting Nuts		
—Coned	175-225	237-305
—Flanged 5/8 x 18	300-350	407-475
—Flanged 1-1/8 x 16	450-500	610-678

BRAKES

CONTENTS

	Page		Page
BRAKING DISC (ROTOR)—BENDIX		CHRYSLER	13
W250, W350	58	HYDRAULIC SYSTEM CONTROL VALVES	24
BRAKING DISC (ROTOR)—CHRYSLER		MASTER CYLINDER	
D150, D250, D350, AD150	39	ALUMINUM	21
W150, W250, AW150	50	CAST IRON	23
DISC BRAKE—BENDIX		PARKING BRAKES	27
W250, W350	52	POWER BRAKE	30
DISC BRAKE—CHRYSLER		SERVICE ADJUSTMENTS	1
D150, D250, D350, AD150	31	SERVICE DIAGNOSIS	8
W150, W250, AW150	42	SPECIFICATIONS	61
DRUM BRAKES		TIGHTENING REFERENCE	62
BENDIX	18	WHEEL CYLINDER	16

GENERAL INFORMATION

All brake systems are power assisted using a 1-1/8 inch diameter aluminum tandem master cylinder.

All front brakes have sliding calipers, with semi-metallic linings.

All models use a combination hold-off and brake warning switch. Some models incorporate a proportioning valve within the same assembly.

SERVICE ADJUSTMENTS

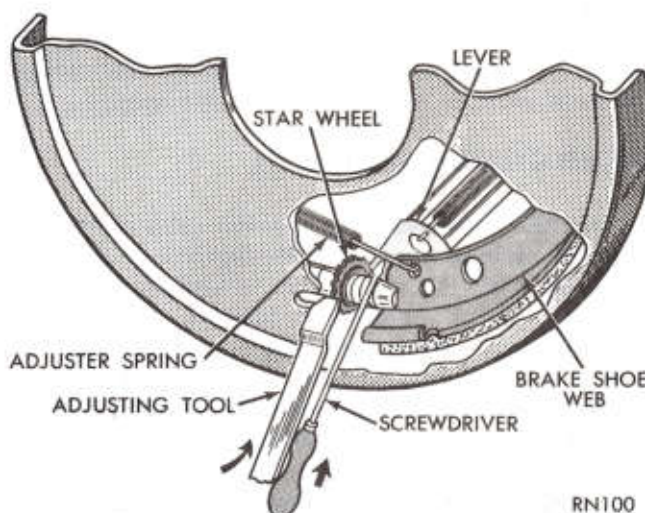
INDEX

	Page		Page
Adjusting Service Brakes	1	Stop Lamp Switch Adjustment	5
Bleeding Brake System	2	Test for Fluid Contamination	3
Brake Hose and Tubing	3	Testing Application Adjuster Operation	2
Master Cylinder Fluid Level	2	Wheel Stud Nut Tightening	3

ADJUSTING SERVICE BRAKES

Normally self-adjusting drum brakes will not require manual adjustment, but in the event of a brake reline it is advisable to make the initial adjustment manually to speed up the adjusting time.

- (1) Jack up vehicle so all wheels are free to turn.
- (2) Remove adjusting hole covers from brake support plates.
- (3) Be sure parking brake lever is fully released, then back off parking brake cable adjustment so there is slack in cable.
- (4) Insert adjusting Tool C-3784, into star wheel of adjusting screw. Move handle of tool upward until a slight drag is felt when road wheel is rotated.
- (5) Insert a thin screwdriver or piece of welding rod into brake adjusting hole and push adjusting lever out of engagement with star wheel (Fig. 1). Care should



RN100

Fig. 1—Adjusting Service Brakes

be taken so as not to bend adjusting lever or distort lever spring. While holding adjusting lever out of engagement, back off star wheel to insure a free wheel with no brake shoe drag.

(6) Repeat above adjustment at each wheel. The adjustment must be equal to all wheels. Install adjusting hole covers in brake supports.

(7) Adjust parking brake **after** wheel brake adjustment.

It is important to follow the above sequence to avoid the possibility of the parking brake system causing brake drag, if the parking brakes are adjusted before the service brakes.

TESTING APPLICATION ADJUSTER OPERATION

Place the vehicle on a hoist, with a helper in the driver's seat to apply the brakes. Remove the access plug from the rear adjustment slot in each brake support plate to provide access to the adjuster star wheel. Then, to eliminate the possibility of maximum adjustment, whereby the adjuster does not operate because the closest possible adjustment has been reached, back the star wheel off approximately 30 notches. It will be necessary to hold the adjuster lever away from the star wheel to permit this adjustment.

Spin the wheel and brake drum in the reverse direction and with greater than normal force apply the brakes suddenly. This sudden application of force will cause the secondary brake shoe to leave the anchor. The wrap up effect will move the secondary shoe, and the cable will pull the adjuster lever up. Upon application of the brake pedal, the lever should move upward, turning the star wheel. Thus, a definite rotation of the adjuster star wheel can be observed if the automatic adjuster is working properly. If one or more adjusters do not function properly, the respective drum must be removed for adjuster servicing.

MASTER CYLINDER FLUID LEVEL

Check the fluid level in the master cylinder twice a year. The aluminum master cylinder nylon reservoir is marked with the words "fill to bottom of rings" indicating proper fluid level. Remove the caps to check the level. **Wipe caps and reservoir clean to prevent dirt and foreign matter from dropping into the reservoir. On the cast iron master cylinder, fill to within a 1/4 inch of the top of reservoir.**

If necessary, add fluid to bring up to the proper level. **With disc brakes, fluid level can be expected to fall as the brake pads wear.** Use only brake fluid conforming to DOT 3. MOPAR Brake Fluid is a fluid of this quality and is recommended to provide best

brake performance. **Use of a brake fluid that may have a lower initial boiling point, such as fluid identified as 70R1 or unidentified as to specification may result in sudden brake failure during hard prolonged braking.** Use only brake fluid that has been stored in a tightly closed container, to avoid contamination with foreign matter or moisture.

CAUTION: Do not allow petroleum base fluid to contaminate the brake fluid. Seal damage will result.

BLEEDING BRAKE SYSTEM

Clean all dirt and foreign material from the top of the master cylinder assembly to prevent dirt from falling into the master cylinder reservoir.

Using the one-man Bleeder Tank C-3496-B provides a convenient means for pressurizing the hydraulic system for bleeding. (Complete bleeding of the dual master cylinder is important! See Bleeding the Master Cylinder in this Group.)

Starting with the right rear wheel, clean all dirt from the bleeder valve. Place bleeder hose on the bleeder valve and insert the other end of the bleeder hose into a clear jar half filled with clean brake fluid. (This will permit the observation of air bubbles as they are being expelled from the hydraulic system and also prevent air from being drawn back into the system. Follow the manufacturers instructions in the use of the bleeder tools).

Continue this bleeding operation with the left rear wheel, then the right front and finishing with the left front wheel.

If necessary, repeat this bleeding operation if there is any indication (a spongy brake pedal or warning light) of air remaining in the hydraulic system.

Brake System Bleeding Procedures

All vehicles are equipped with a pressure hold-off valve. The valve is located (in the combination valve) on the left frame rail. The use of the hold-off valve is to better match front disc brakes with the rear drum brakes, resulting in improved braking and steering control on icy surfaces.

Due to operating characteristics of the valve, which causes complete shut-off of the flow of brake fluid between approximately 3 and 135 psi, front brake bleeding procedures should be done as follows:

(1) **Gravity Bleed:** This method of bleeding is not affected by the hold-off valve, as fluid pressures are always below 3 psi. Remove master cylinder reservoir cover and gasket, then fill reservoirs with approved brake fluid. Open disc brake bleeder screws, and allow fluid and air to drain until stream of fluid is free of air.

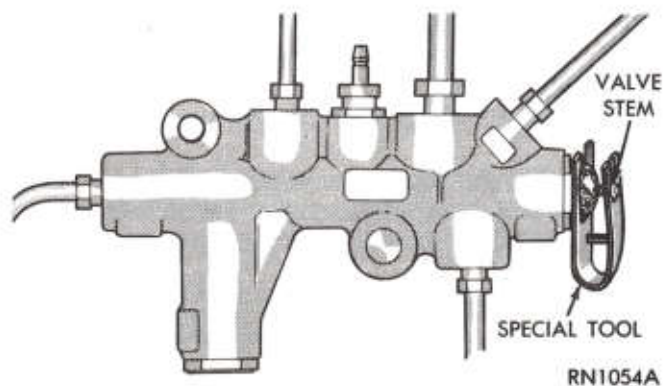


Fig. 2—Extending Valve Stem

(2) **Pedal Bleed:** This method of bleeding is not affected by the hold-off valve, as fluid pressures are in excess of 135 psi. Follow normal procedure of pumping pedal and opening bleeder screws. **Do not pump master cylinder dry!**

(3) **Pressure Bleed:** This method of bleeding is influenced by the hold-off valve. Bleed pressure, normally about 35 psi, is high enough to cause the hold-off valve to close, stopping the flow of fluid to the front brakes. However, the valve (Fig. 2) must be held open manually by using Tool C-4121, to pull the valve stem out.

CAUTION: Under no condition should a rigid clamp, wedge or block be used to depress the valve stem, as this can cause an internal failure in the valve, resulting in complete loss of front brakes.

It should be noted that the pressure release valve stem is in its innermost position when there is no pressure present. No attempt should be made to further depress the valve stem.

If diagnosis determines that master cylinder alone is cause of trouble, it can be replaced without bleeding the hydraulic system provided the replacement cylinder is completely bled before installation. (See — Bleeding Master Cylinder). After brake tubes are connected, have helper apply force to pedal while both tube nuts are cracked to release any air and then retightened.

TEST FOR FLUID CONTAMINATION

Swollen rubber parts indicate the presence of petroleum in the brake fluid. To confirm that contamination exists, make the following test.

Place a small amount of the drained brake fluid into a small clear glass bottle. Separation of the fluid into distinct layers will indicate mineral oil content.

If there is any question of mineral oil content, drain system, flush thoroughly and replace all rubber parts.

WHEEL STUD NUT TIGHTENING

The tightening sequence and torquing of the wheel stud nuts is of great importance to insure efficient brake operation. The use of an impact or long-handled wrench may distort the drum.

Use a criss-cross tightening sequence (Fig. 3). Tighten all the stud nuts to one-half the specified torque first, and then repeat the sequence tightening to the specified torque.

BRAKE HOSE AND TUBING

Inspection of Brake Hose and Tubing

Flexible rubber hose is used at both front brakes and at a rear axle junction block.

Inspection of brake hoses should be performed whenever the brake system is serviced and every 7,500 miles or 12 months, whichever comes first (every engine oil change). Inspect hydraulic brake hoses for severe surface cracking, scuffing, or worn spots. Should the fabric casing of the rubber hose be exposed due to cracks or abrasions in the rubber hose cover, the hose should be replaced immediately! Eventual deterioration of the hose can take place with possible burst failure. Faulty installation can cause twisting, and wheel, tire or chassis interference.

The steel brake tubing should be inspected periodically for evidence of physical damage that may restrict fluid flow. Heavily corroded tubing may eventually develop a leak. In either case, the tubing should be replaced.

Installation of Brake Hose

Always use factory recommended hose to insure quality, correct length and superior fatigue life. Care should be taken to make sure that the tube and hose

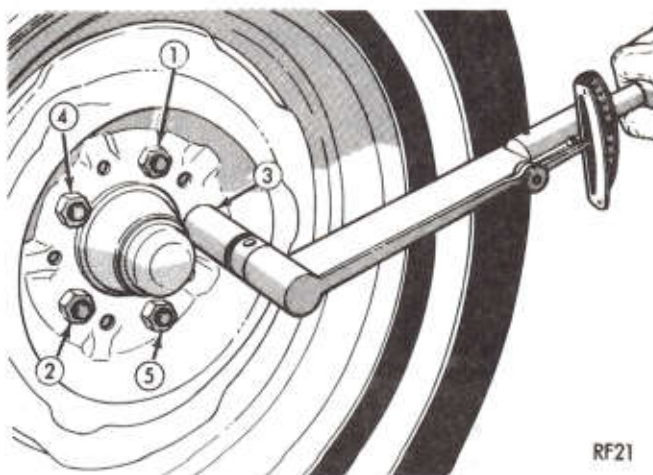


Fig. 3—Wheel Stud Tightening Sequence

mating surfaces are clean and free from nicks and burrs. **Right and left brake hoses are not interchangeable.**

Use new, copper seal washers. All connections should be tight and properly made.

The flexible hydraulic brake hose should **always** be installed on the vehicle by first tightening the block end of the hose onto caliper, or rear axle housing tee. The intermediate bracket should then be bolted to the upper control arm. The hose bracket is then attached to the side rail. Finally, the tube is attached to the hose.

Repair and Installation of Brake Tubing

Double-wall steel tubing should always be used for replacement. Care should be taken when replacing brake tubing (Figs. 6 and 7), to use the proper bending and flaring tools and to avoid kinking or routing the tubes against sharp edges, moving components, or in hot areas. All tubes should be properly attached with recommended retaining clips.

Steel tubing is used to conduct hydraulic pressure to the front and rear brakes. Steel tubing is used from the junction block to both rear wheel cylinders. All fittings, tubing and hoses should be inspected for rusted, damaged or defective flaring seats. The steel tubing is equipped with a double flare inverted seat to insure more positive seating in the fitting. To repair or reflare tubing proceed as follows:

(1) Using Tool C-3478-A, or equivalent, cut off damaged seat or damaged tubing (Fig. 4).

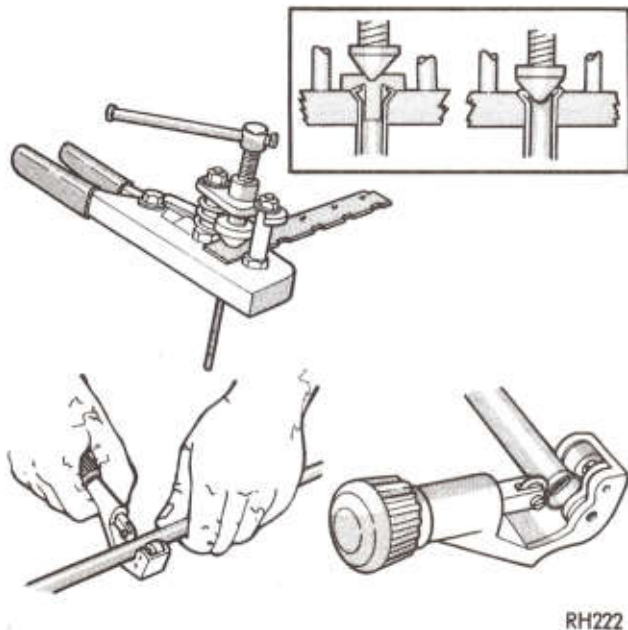


Fig. 4—Cutting and Flaring Steel Tubing

(2) Ream out any burred or rough edges showing on inside edges of tubing. This will make the ends of tubing square and insure better seating of flared end tubing. **Place tube nut on tubing prior to flaring tubing.**

(3) To flare tubing, open handles of flaring Tool C-4047 and rotate jaws of tool until the mating jaws of tubing size are centered in area between vertical posts.

(4) Slowly close handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

(5) Place gauge "Form A" on edge over end of tubing and push tubing through jaws until end of tubing contacts the recessed notch of gauge matching the size of tubing (Fig. 4).

(6) Squeeze handles of flaring tool and lock tubing in place.

(7) Place 3/16 inch plug of gauge "A" down in end of tubing. Swing compression disc over gauge and center tapered flaring screw in recess of disc.

(8) Screw in until plug gauge has seated on jaws of flaring tool. This action has started to invert the extended end of the tubing.

(9) Remove gauge and continue to screw down until tool is firmly seated in tubing.

(10) Remove tubing from flaring tool and inspect seat.

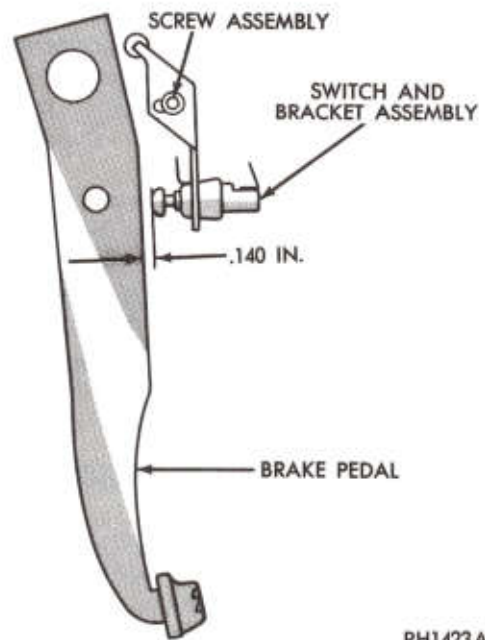


Fig. 5—Stop Lamp Switch Adjustment without Speed Control

STOP LAMP SWITCH ADJUSTMENT

The stop lamp (or stop lamp/speed control) switch and mounting bracket assembly is attached to the brake pedal bracket. The switch is actuated by the brake pedal blade on all models and is adjusted as follows:

Without Speed Control

(1) Loosen switch assembly to pedal bracket attaching screw and slide assembly away from pedal blade or striker plate.

(2) Push brake pedal down and allow to return to free position, **do not pull brake pedal back at any time.**

(3) Place proper spacer gauge on pedal brake.

(4) Slide switch assembly toward pedal blade until

switch plunger is fully depressed against spacer gauge without moving the pedal.

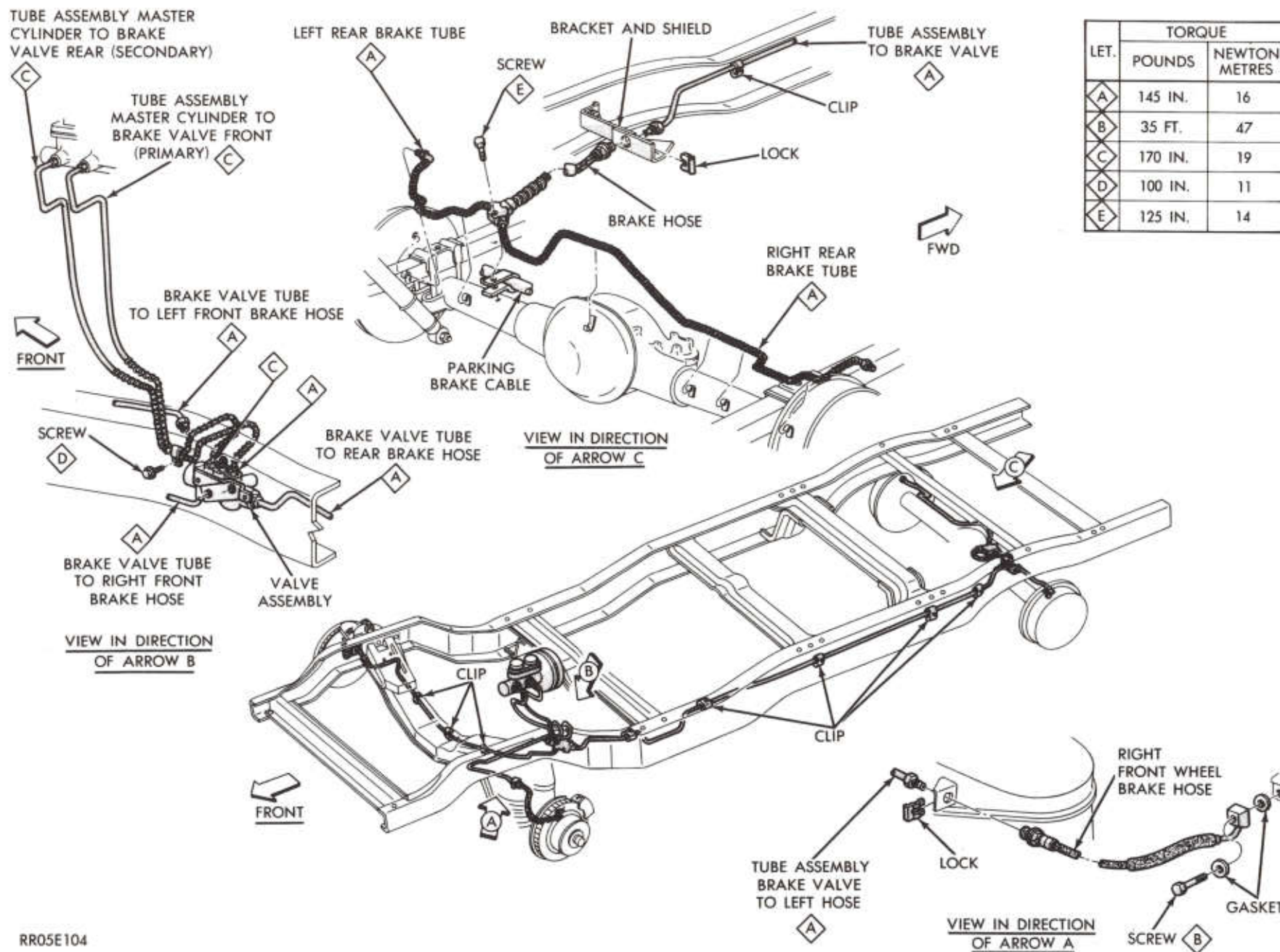
(5) Retighten the switch bracket screw to 82 in. lbs. (9 N·m).

(6) Remove spacer. Be sure that stop lamp switch does not prevent full pedal return. Incomplete pedal return can cause brake drag and premature lining and rotor wear.

With Speed Control

(1) Push switch through clip in mounting bracket until switch is sealed against bracket. The brake pedal will move forward slightly.

(2) Gently pull back on the brake pedal as far as it will go, the switch will ratchet backwards to the correct position and no further adjustment is required.



RR05E104

Fig. 6—Brake Hose and Tube Routing AD150, D150, 250, 350 (Two-Wheel-Drive)

LET.	TORQUE	
	POUNDS	NEWTON METRES
A	145 IN.	16
B	125 IN.	14
C	100 IN.	11
D	170 IN.	19

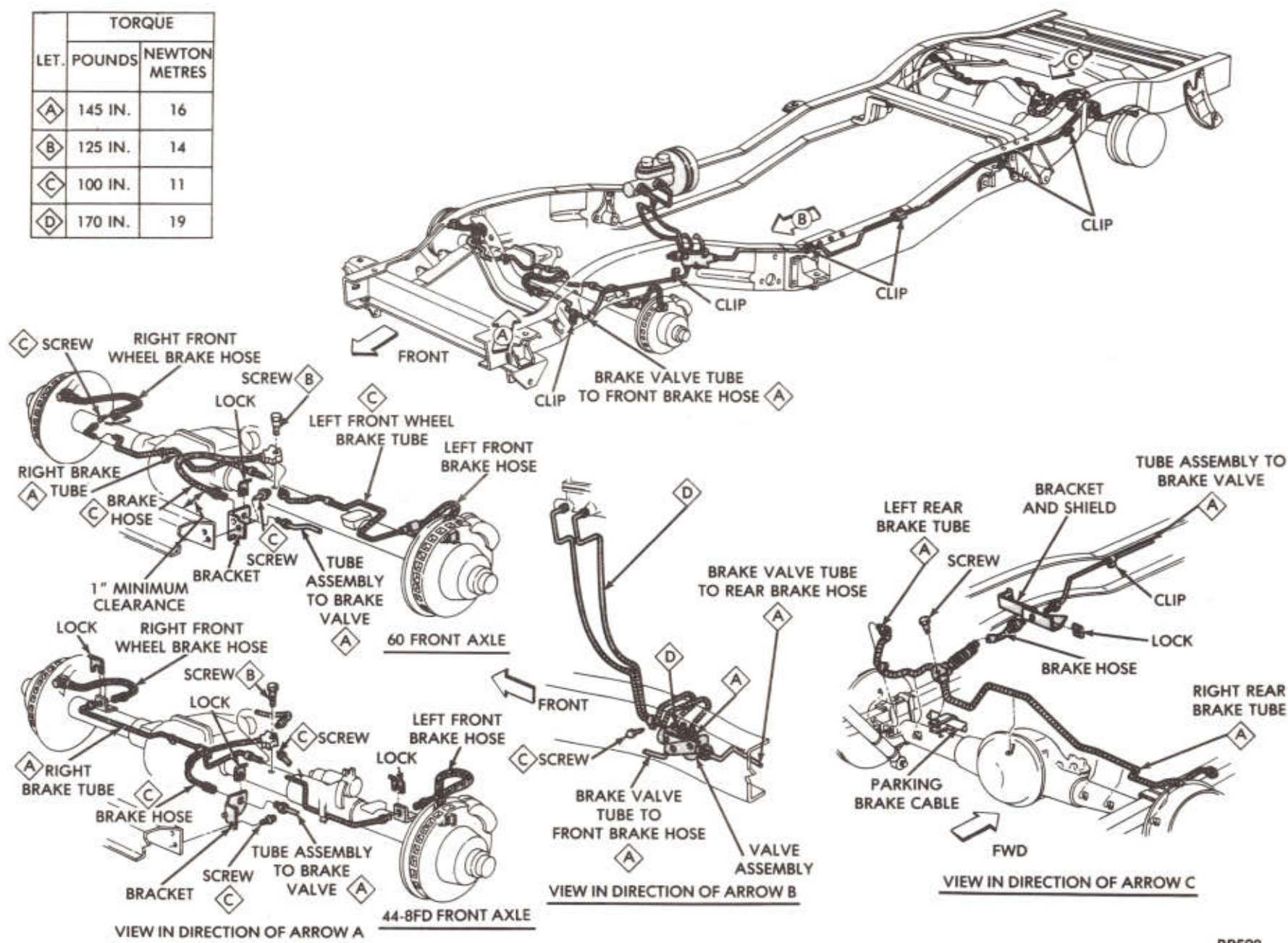


Fig. 7—Brake Hose and Tube Routing AW150, W150, 250, 350 (Four-Wheel-Drive)

BASIC DIAGNOSIS GUIDE

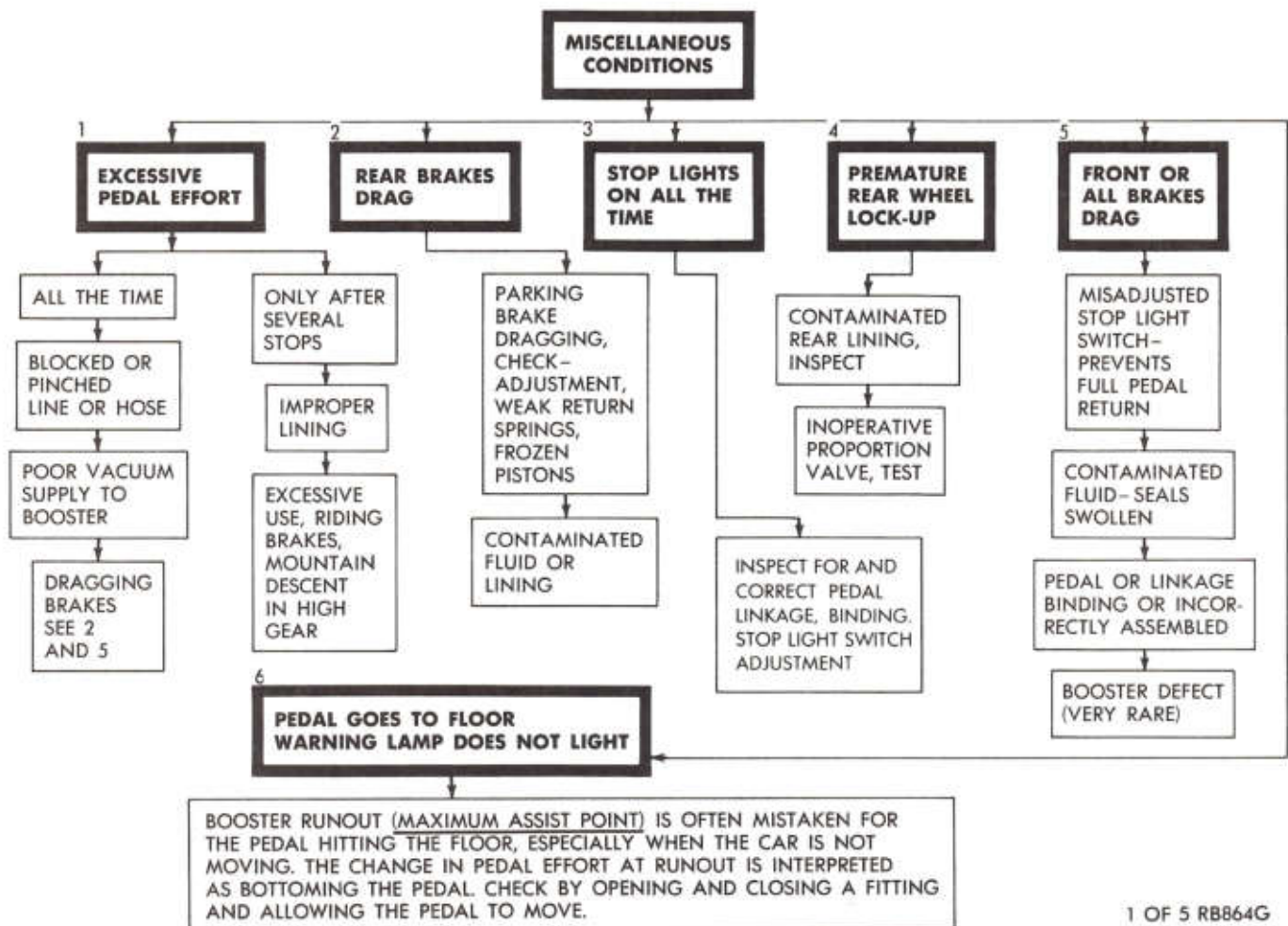
SYMPTOM	CHART 1 MISC. COND.	CHART 2 ACTUATION	CHART 3 POWER	CHART 4 NOISE	CHART 5 WHEEL BRAKES	CHART 6 PULL
BRAKE WARNING LIGHT "ON"		X	NO		O	
EXCESSIVE PEDAL TRAVEL-SPONGY PEDAL		X	NO		O	
PEDAL GOES TO FLOOR	6	X	O			
STOP LIGHT "ON" ALL THE TIME	3		O			
BRAKES DRAG-FRONT OR ALL	5	X	O			
REAR BRAKES DRAG	2		NO			
GRABBY BRAKES					X	
EXCESSIVE PEDAL EFFORT	1		X		O	
ROUGH ENGINE IDLE			O			
BRAKE CHATTER (ROUGH)		NO	NO		X	
SURGE DURING BRAKING		NO	NO		X	
NOISE DURING BRAKING		NO		X		
PEDAL PULSES DURING BRAKING		NO	NO		X	
RATTLE OR CLUNKING NOISE		NO		X		
PREMATURE REAR WHEEL LOCKUP	4	NO	NO			
PULL TO RIGHT OR LEFT		NO	NO		X	X

X-MOST LIKELY CAUSE

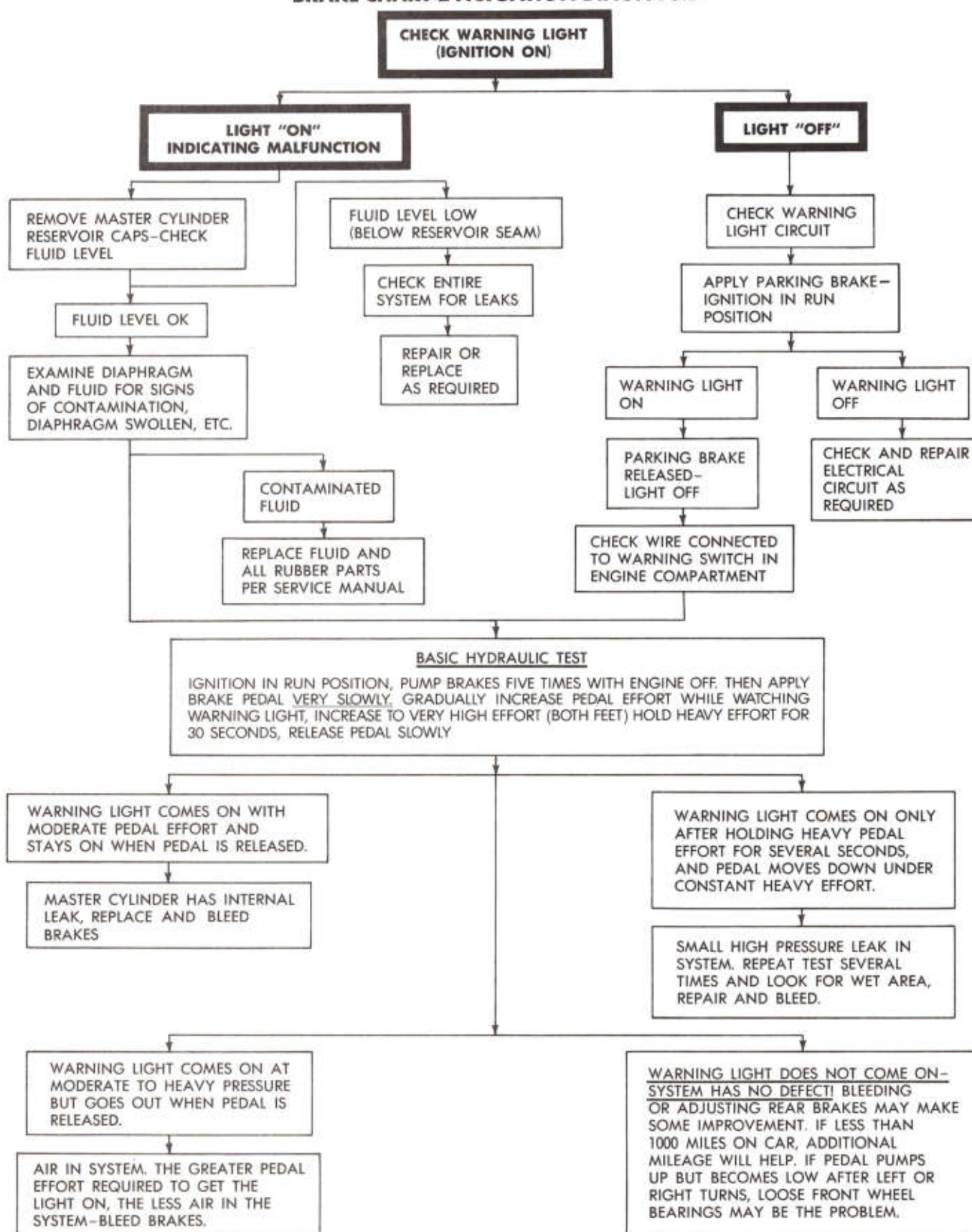
O-POSSIBLE CAUSE

NO-NOT POSSIBLE CAUSE

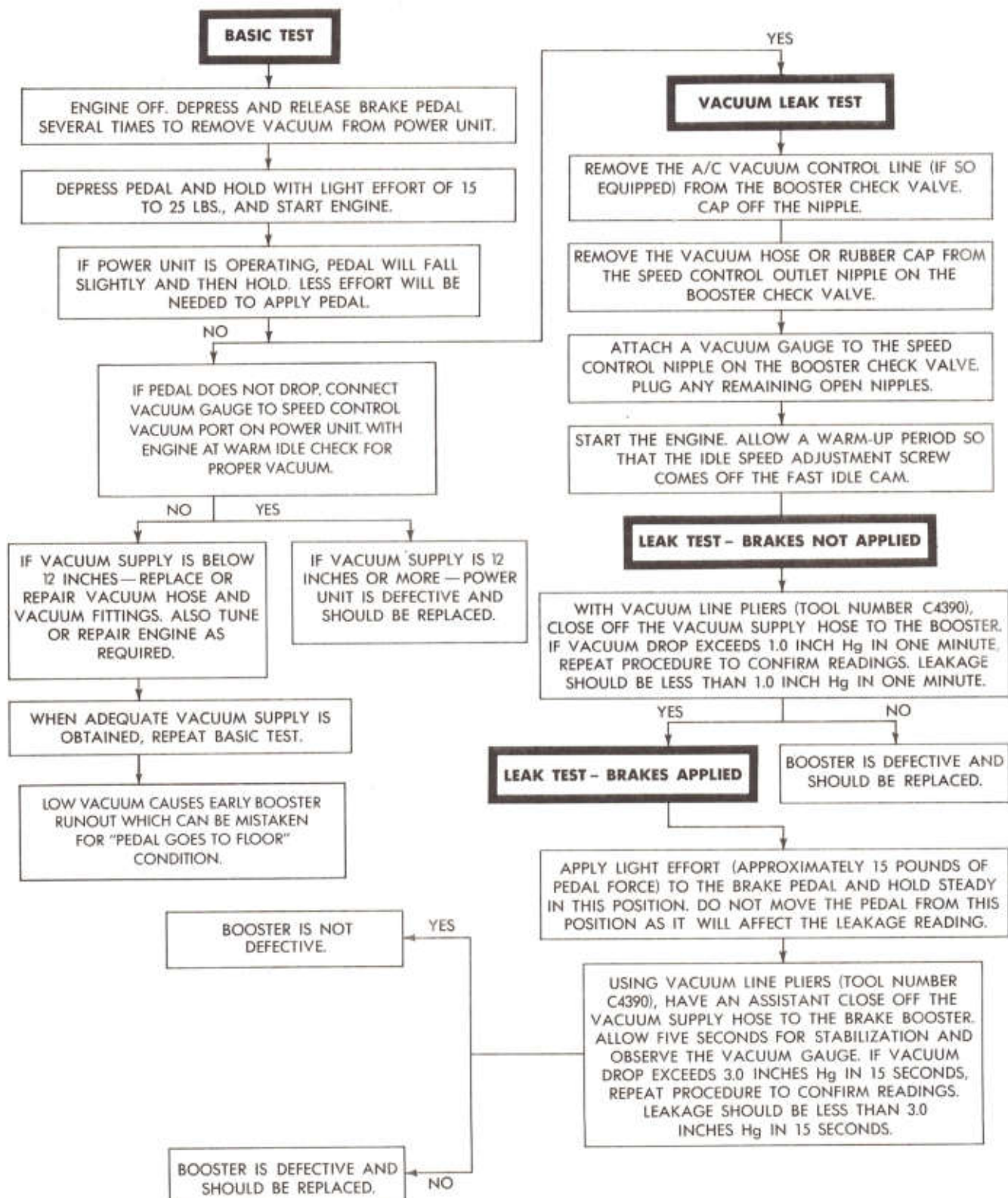
BRAKE CHART 1 DIAGNOSIS



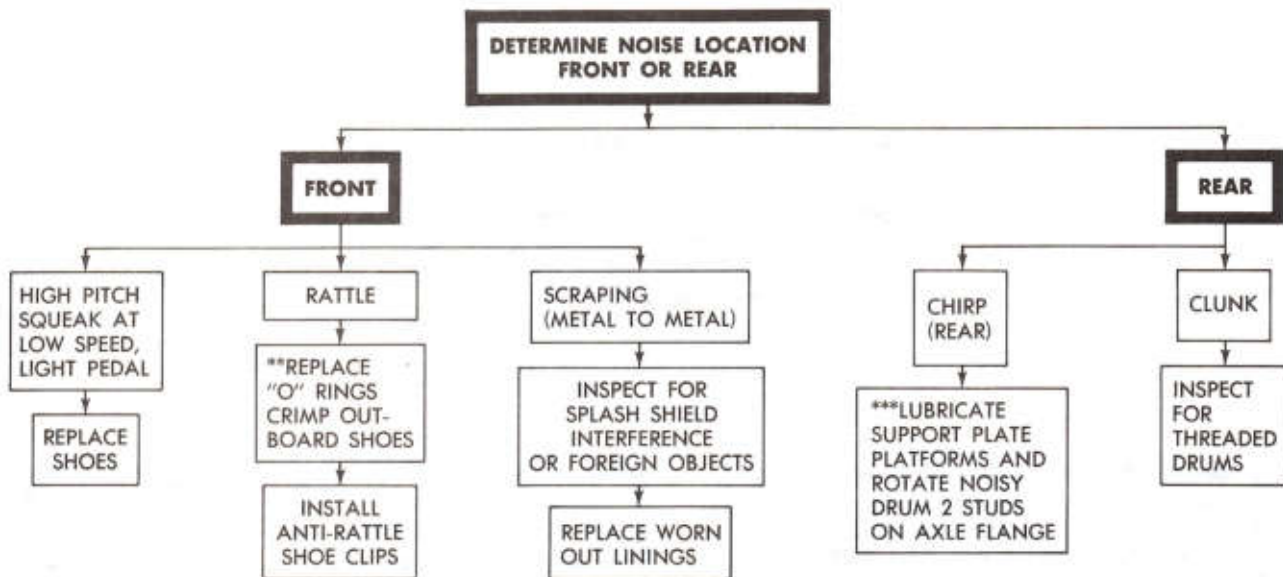
BRAKE CHART 2 ACTUATION DIAGNOSIS



BRAKE CHART 3 TROUBLESHOOTING POWER BRAKE DIAGNOSIS

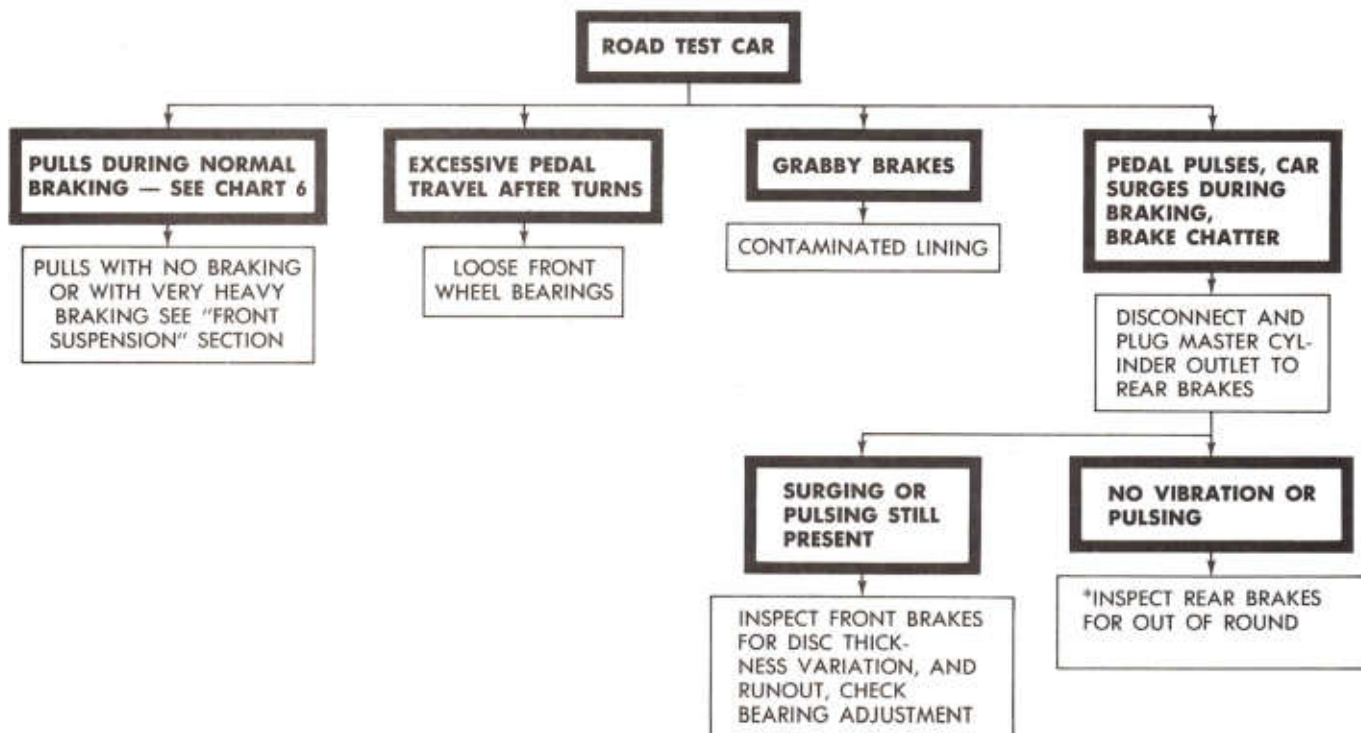


BRAKE CHART 4 BRAKE NOISE DIAGNOSIS



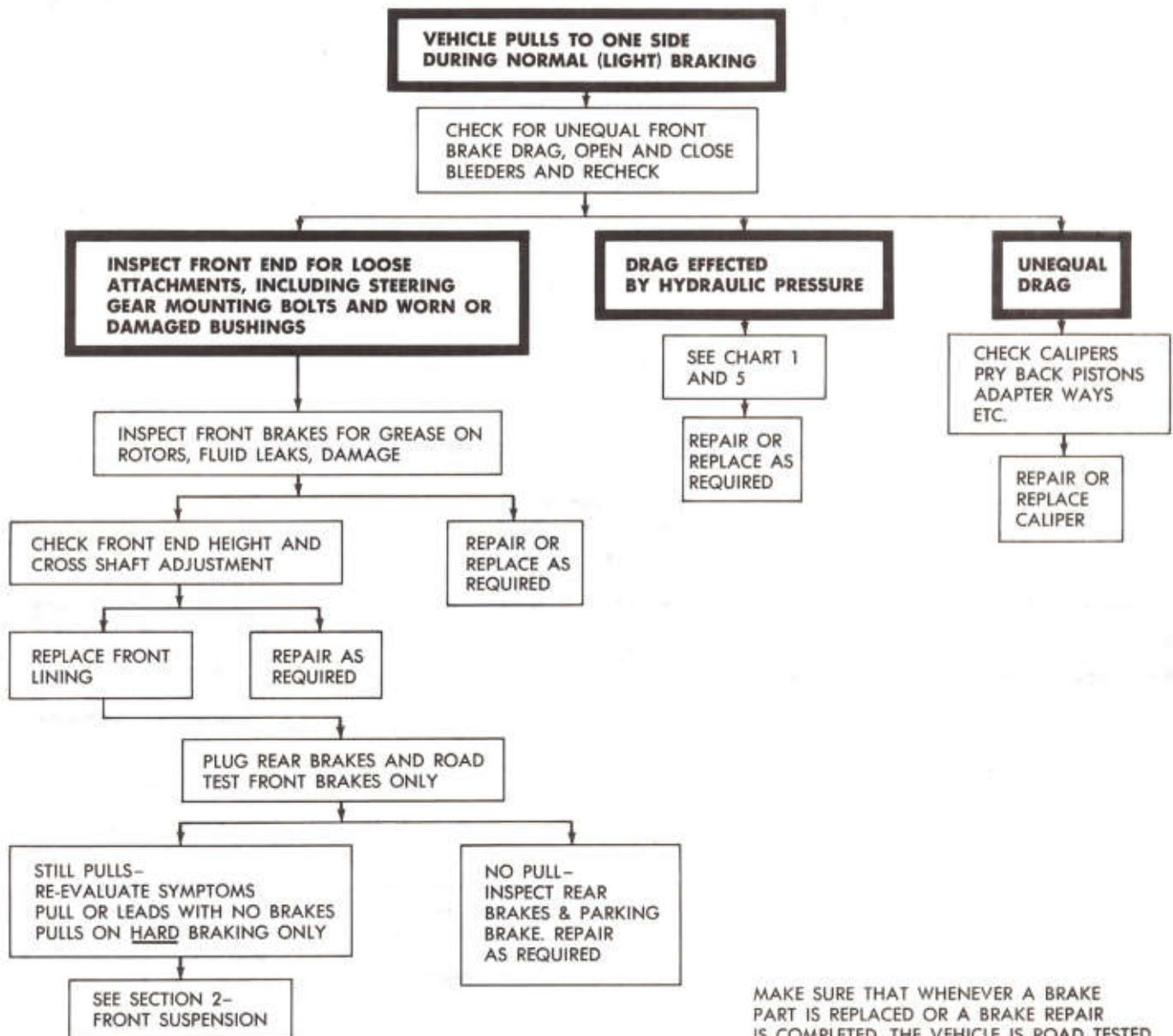
**INSTALL "O" RINGS (AROUND ADAPTER) BETWEEN MACHINED "WAYS" OF CALIPER AND ADAPTER.
 ***MOPAR MULTIPURPOSE LUBRICANT, PART NUMBER 438063, OR EQUIVALENT.

BRAKE CHART 5 WHEEL BRAKES DIAGNOSIS



*PULSATION CAUSED BY REAR BRAKES MAY BE ELIMINATED OR REDUCED BY INDEXING DRUM (REAR) TWO STUDS ON AXLE FLANGE.

BRAKE CHART 6 BRAKE PULL DIAGNOSIS



DRUM BRAKES — CHRYSLER

INDEX

	Page		Page
Brake Drum Removal	13	Cleaning and Inspection	14
Brake Shoe Removal	14	Drum Refacing Recommendations	14
Brake Drum Installation	16	General Information	13
Brake Shoe Installation	15	Service Diagnosis	8

GENERAL INFORMATION

All drum brake applications are two shoe, internal expanding brakes with application adjusters. The lower ends of the brake shoes are connected by a tubular star wheel adjusting screw (Figs. 1 and 2).

WARNING: DUST AND DIRT ON BRAKE PARTS GENERATED DURING THE NORMAL USE AND WEAR OF MOTOR VEHICLE BRAKE SYSTEMS CAN CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM, SUCH AS A ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING BRAKE ASSEMBLIES OR COMPONENTS.

DO NOT CLEAN BRAKE ASSEMBLIES OR COMPONENTS WITH COMPRESSED AIR OR BY DRY BRUSHING; USE A VACUUM CLEANER SPECIFICALLY RECOMMENDED FOR USE WITH ASBESTOS

FIBERS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WET USING A WATER DAMPENED CLOTH.

DO NOT CREATE DUST BY SANDING, GRINDING, AND/OR SHAVING BRAKE LININGS OR PADS UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

SERVICE PROCEDURES

BRAKE DRUM REMOVAL

- (1) Remove rear plug from brake adjusting access hole.

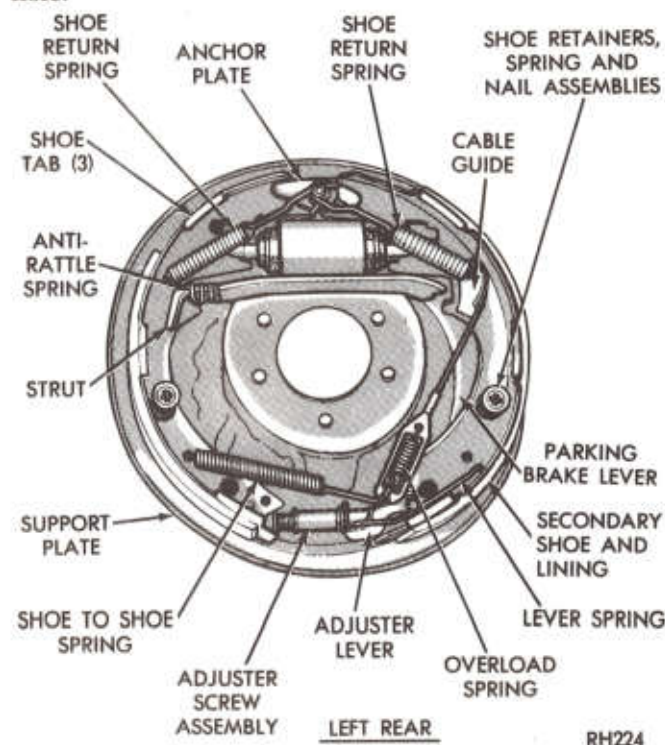


Fig. 1—Eleven Inch Brake Assembly

- (2) Insert a thin screwdriver into brake adjusting hole and hold adjusting lever away from notches of adjusting screw.

- (3) Insert Tool C-3784 into brake adjusting hole and engage notches of brake adjusting screw. Release brake by prying down with adjusting tool.

- (4) Remove rear wheel and clips from wheel studs that holds drum on axle. Discard clips. Remove drums.

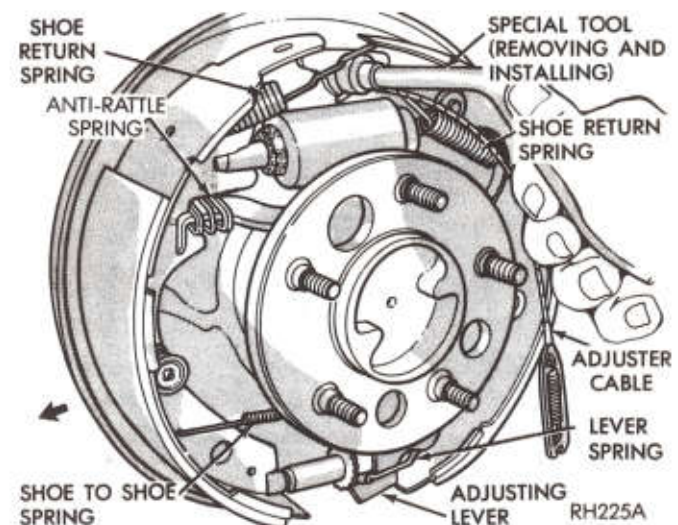


Fig. 2—Removing Shoe Return Springs

(5) Inspect brake lining for wear, shoe alignment, or contamination from grease or brake fluid.

BRAKE SHOE REMOVAL

- (1) Remove brake drum.
- (2) Using Tool C-3785, remove brake shoe return springs (Fig. 2). (Note how secondary shoe return spring overlaps primary shoe return spring) (Fig. 1).
- (3) Slide eye of automatic adjuster cable off anchor and then unhook from adjusting lever. Remove cable assembly, cable guide, and anchor plate.
- (4) Disengage adjusting lever from spring by sliding forward to clear pivot, then working out from under spring. Remove spring from pivot. Remove shoe-to-shoe spring from secondary shoe web and disengage from primary shoe web. Remove spring.
- (5) Disengage primary and secondary shoes and remove adjusting star wheel assembly from shoes.
- (6) Remove brake shoe retainers, springs and nails using Tool C-4070, (Fig. 3), and remove from support.
- (7) Remove parking brake lever from secondary shoes. Remove shoes.
- (8) Disengage parking brake lever from parking brake cable.

CLEANING AND INSPECTION

Wipe with water dampened cloth the metal portions of the brake shoes. Examine the lining contact pattern to determine if the shoes are bent. The lining should show contact across the entire width, extending from heel to toe. Shoes showing contact only on one side should be replaced. Shoes having sufficient lining but lack of contact at toe and heel may be improperly ground.

Clean the support, using a suitable solvent, then inspect for rough or rusted shoe contact areas. Clean and inspect the adjusting screws for damaged threads, then apply a thin film of lubricant to the threads,

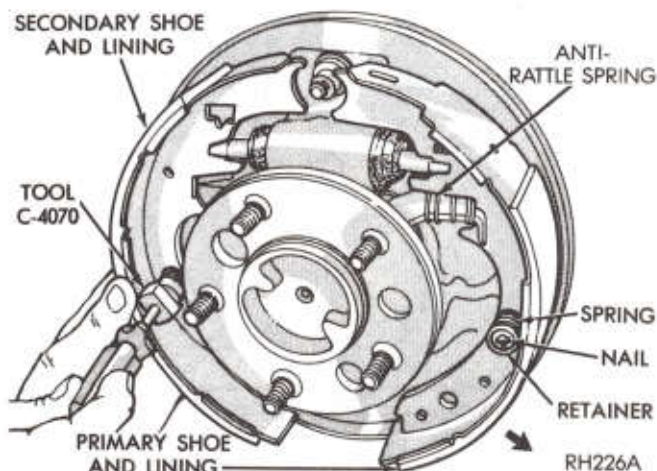


Fig. 3—Removing or Installing Shoe Retainers, Springs, and Nails

socket and washer (Fig. 8). Replace adjuster screw assembly if corrosion of any part inhibits very free operation.

Install new brake shoe return springs and hold down springs where the old springs have been subjected to overheating or if their strength is questionable. Spring paint discoloration or distorted end coils indicate a spring that had been overheated.

DRUM REFACING RECOMMENDATIONS

Drum Refacing—Measure the drum runout and diameter with an accurate gauge. There should be no variation in the drum diameter greater than .004 inch (.09mm). Drum runout should not exceed .008 inch (.20mm) out of round. If the drum runout or diameter variation exceed these values the drum should be refaced. For best results in eliminating the irregularities that cause brake roughness and surge, the amount of material removed during a single cut should be limited to .005 inch. When the entire braking surface has been cleaned, a final cut of .001 inch will assure a good drum surface, providing the equipment used is capable of giving the precision required for resurfacing brake drums. Deeper cuts are permissible for the sole purpose of removing deep score marks. **Do not reface more than .060 inch over the standard drum diameter.**

All drums will show markings of maximum allowable diameter (Fig. 4). For example, an eleven inch drum will have a marking of MAX. DIA. 11.090 inch. This marking includes .030 inch for allowable drum

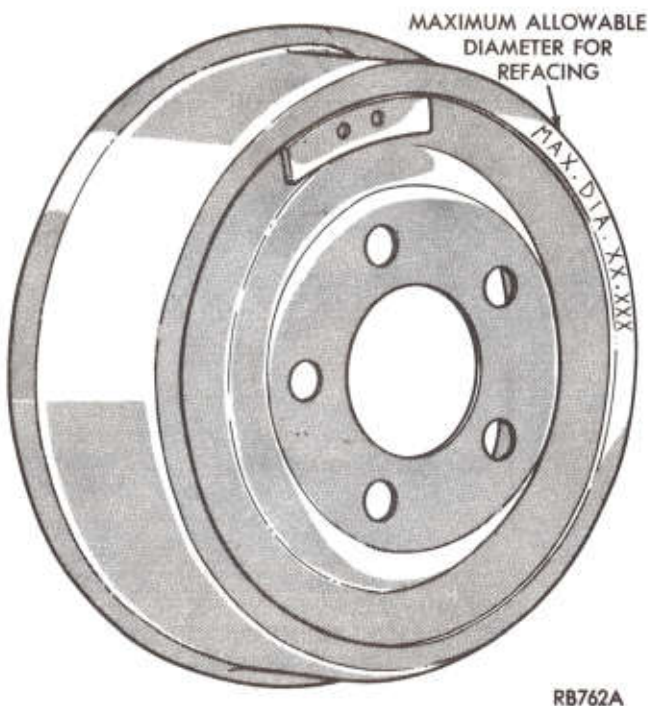


Fig. 4—Eleven Inch Drum Maximum Diameter Identification

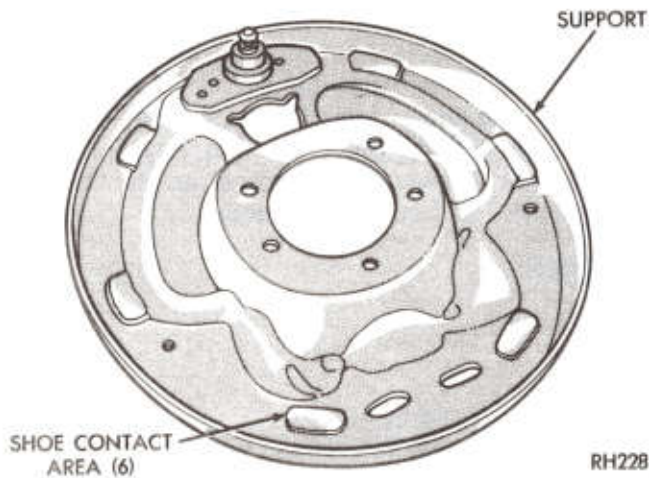


Fig. 5—Shoe Contact Pads on Support

wear beyond the recommended .060 inch of drum refacing.

BRAKE SHOE INSTALLATION

Lubricate the six shoe tab contact pads on support plate with a thin film of MOPAR Multi-Purpose Lubricant, Part number 4318063 or equivalent (Fig. 5).

(1) Engage parking brake lever with cable. Install parking brake lever into rectangular hole of secondary brake shoe.

(2) Slide secondary shoe against support plate, at the same time engage shoe web with push rod and against anchor.

(3) Slide parking brake strut behind axle flange and into slot in parking brake lever. Slide anti-rattle spring over free end of strut (Fig. 6).

(4) Slide primary shoe into position and engage with push rod (if so equipped) and free end of strut.

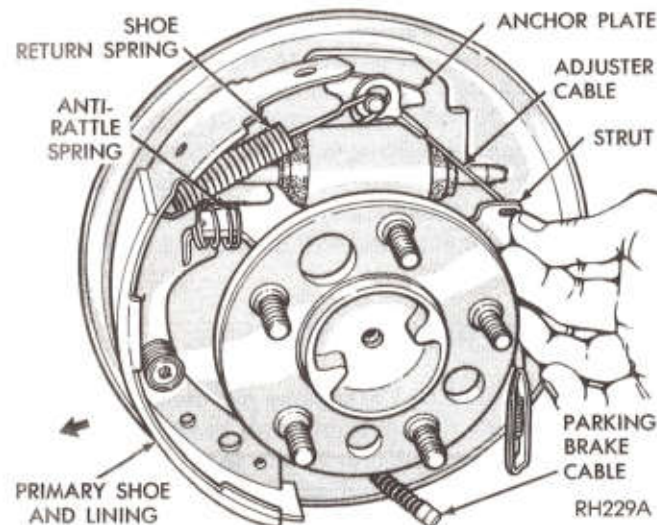


Fig. 6—Removing or Installing Parking Brake Strut and Spring

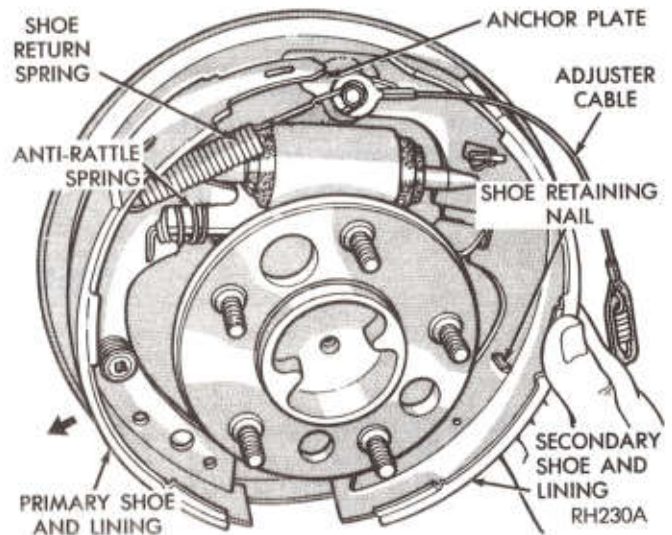


Fig. 7—Installing Brake Shoes

Install anchor plate over anchor, then install eye of adjuster cable over anchor (Fig. 7).

(5) Engage primary shoe return spring in web of shoe and install free end over anchor, using Tool C-3785.

(6) Insert protruding hole rim of cable guide into hole in secondary shoe web. Holding guide in position, engage secondary shoe return spring through both, hole in guide, and hole in web. Using Tool C-3785, install spring over anchor. (Be sure cable guide remains flat against shoe web and that secondary spring overlaps primary) (Fig. 1). Using pliers, squeeze ends of spring loops (around anchor) until parallel.

(7) Install adjusting star wheel assembly between primary and secondary shoes, with star wheel next to secondary shoe (Fig. 8). The left star wheel adjusting stud end is stamped "L" (indicating its position on the vehicle) and the star wheel is cadmium plated. The right star wheel is black and the adjusting stud end is stamped "R". Install shoe-to-shoe spring between shoes (Figs. 1 and 2). Engage primary shoe first with coil forward, opposite adjuster lever (Fig. 1).

(8) Install adjusting lever spring over pivot pin on shoe web. Install adjusting lever under spring and over pivot pin. Slide lever slightly rearward to lock in position.

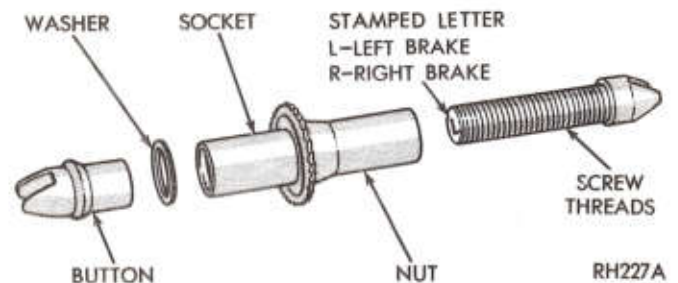


Fig. 8—Adjuster Screw Assembly

(9) Using Tool C-4070, install shoe retaining nails, retainers and springs (Fig. 3).

(10) Thread adjuster cable over guide and hook end of overload spring in lever (Fig. 1). (Be sure eye of cable is pulled tight against anchor and in a straight line with guide).

BRAKE DRUM INSTALLATION

(1) Install brake drum. Reinstallation of retaining clips is not necessary. Install wheel and tire assembly as described under "Wheel Stud Nut Tightening."

(2) Adjust brakes as described under "Service Adjustments" at front of this Group.

WHEEL CYLINDER

INDEX

	Page
Assembling Wheel Cylinders	16
Disassembling Wheel Cylinders	16
General Information	16
Installing Brake Support Plate	17

	Page
Installing Wheel Cylinders	17
Removing Brake Support Plate	17
Removing Wheel Cylinders	16

GENERAL INFORMATION

The piston boots are of the press-on type and prevent moisture from entering the wheel cylinder.

To perform service operations or inspections of the wheel cylinders, it will be necessary to remove the cylinders from the support plate and disassemble on

the bench.

CAUTION: Wheel cylinders with cup expanders **MUST** have cup expanders after any service procedures (reconditioning or replacement).

SERVICE PROCEDURES

REMOVING WHEEL CYLINDERS

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Block brake pedal in stroke position, visually check the boots for cuts, tears, or heat cracks, and if any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed (Fig. 1). (A slight amount of fluid on the boot may not be a leak, but may be preservative fluid used at assembly.)

(1) In case of a leak, remove brake shoes, (replace if soaked with grease or brake fluid).

(2) Disconnect brake tube from wheel cylinder.

(3) Remove wheel cylinder attaching bolts, then pull wheel cylinder assembly out of support plate.

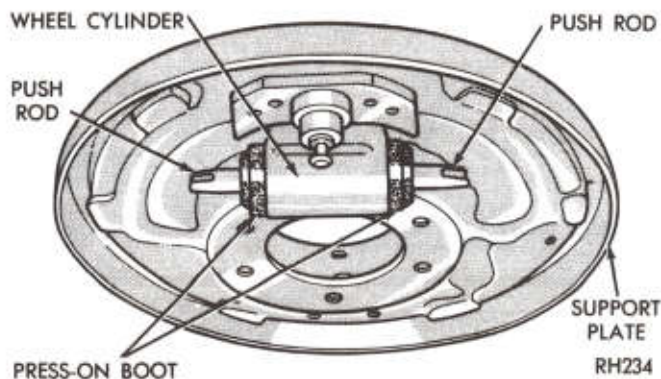


Fig. 1—Wheel Cylinder Installation

DISASSEMBLING WHEEL CYLINDERS

To disassemble the wheel cylinders (Fig. 2), proceed as follows:

(1) Using a suitable tool, pry boots away from cylinders and remove. Remove push rods.

(2) Press in on one piston and force out piston, cup, spring (with cup expanders), cup and piston.

(3) Wash wheel cylinder, pistons, and spring in clean brake fluid or alcohol; clean thoroughly and blow dry with compressed air. Inspect cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will adhere to bore surfaces.)

Wheel cylinder bores and pistons that are badly scored or pitted should be replaced. Cylinder walls that have light scratches, or show signs of corrosion, can usually be cleaned with crocus cloth, using a circular motion. Black stains on the cylinder walls are caused by piston cups and will not impair operation of cylinder.

ASSEMBLING WHEEL CYLINDERS

Before assembling the pistons and new cups in the wheel cylinders, dip them in clean brake fluid. If the boots are deteriorated, cracked or do not fit tightly on the push rods or the cylinder casting, install new boots.

(1) Coat cylinder bore with clean brake fluid.

(2) Install expansion spring with cup expanders in

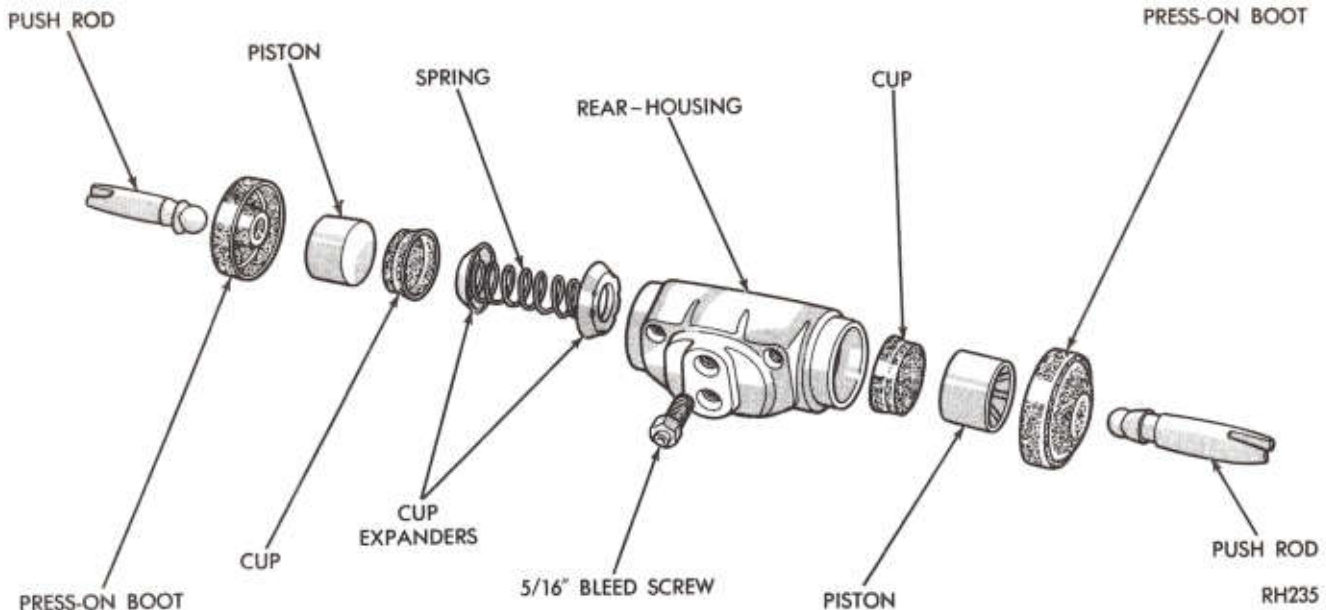


Fig. 2—Rear Wheel Cylinder 11 and 12 Inch Brakes

cylinder. Install cups in each end of cylinder with open end of cups facing each other.

(3) Install piston in each end of cylinder having the flat face of each piston contacting the flat face of each cup, already installed.

(4) Install a boot over each end of cylinder and press over ends until boot is seated against cylinder shoulder. **Use care not to damage boot.**

(5) Lubricate spherical end of each push rod with brake fluid and insert each into boot.

INSTALLING WHEEL CYLINDERS

(1) Apply RTV sealant around wheel cylinder mounting surface.

(2) Slide wheel cylinder into position on support plate. Install mounting screws and tighten as specified.

(3) Connect brake tube to wheel cylinder.

REMOVING BRAKE SUPPORT PLATE

(1) With wheel and brake drum removed, remove brake shoe assemblies and disconnect brake cable.

(2) Using a suitable tool such as an aircraft-type hose clamp, compress the flared legs of cable retainer and pull brake cable out of support plate (Fig. 3).

(3) Disconnect hydraulic brake tube from wheel cylinder.

(4) Remove support plate to wheel cylinder attaching nuts and washers.

(5) Remove rear axle shaft and retainer. Refer to "Rear Axle," Group 3.

(6) Remove brake support plate from rear axle housing.

INSTALLING BRAKE SUPPORT PLATE

(1) Install support plate onto rear axle housing.

(2) Insert rear axle shaft and retainer into housing and install axle retainer nuts and washers. Refer to "Rear Axle," Group 3.

(3) Install wheel cylinder and attach hydraulic brake tube.

(4) Insert parking brake cable into support plate and attach cable to parking brake lever.

(5) Install brake shoes on support plate.

(6) Install brake drum and wheel. Adjust and bleed brakes.

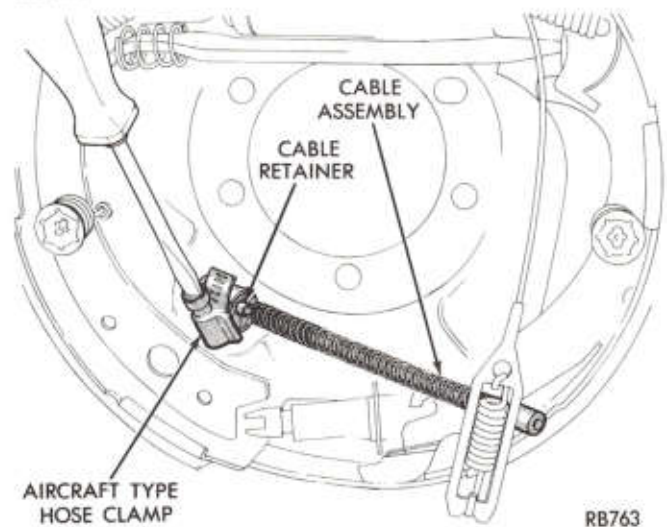


Fig. 3—Removing Brake Cable from Support Plate

DRUM BRAKES — BENDIX

INDEX

	Page		Page
General Information	18	Brake Shoe Removal	18
Brake Drum Installation	21	Cleaning and Inspection	18
Brake Drum Removal	18	Drum Refacing	20
Brake Shoe Installation	21		

GENERAL INFORMATION

The Bendix Duo-Servo is a single anchor brake of an advanced and improved design. These rear brake assemblies include a parking brake lever and cam plate (Fig. 1), and are self-adjusting.

A two-piston wheel cylinder is mounted in an indentation on the support plate. The wheel cylinder must be removed from the support plate for servicing.

Each brake shoe is held against the support plate by a coil spring hold-down pin combination (Fig. 2).

Each support plate has six guide pads (Fig. 3). The shoe webs ride against these pads.

Brake shoes are marked "pri". (primary) and "sec". (secondary) and also "This Side Out" for easy identification and application (Fig. 4).

WARNING: DUST AND DIRT ON BRAKE PARTS GENERATED DURING THE NORMAL USE AND WEAR OF MOTOR VEHICLE BRAKE SYSTEMS CAN CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM, SUCH AS A ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING BRAKE ASSEMBLIES OR

COMPONENTS.

DO NOT CLEAN BRAKE ASSEMBLIES OR COMPONENTS WITH COMPRESSED AIR OR BY DRY BRUSHING; USE A VACUUM CLEANER SPECIFICALLY RECOMMENDED FOR USE WITH ASBESTOS FIBERS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WET USING A WATER DAMPENED CLOTH.

DO NOT CREATE DUST BY SANDING, GRINDING, AND/OR SHAVING BRAKE LININGS OR PADS UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

SERVICE PROCEDURES

BRAKE DRUM REMOVAL

(1) Raise vehicle on hoist or jacks and install jack stands for safety.

(2) Remove wheel and tire assembly.

(3) Remove axle shaft nuts, washers and cones. Rap axle shaft sharply in center to release cones if they do not readily release. Remove axle shaft.

(4) Remove outer hub nut. Straighten lock washer, remove it, remove inner nut and bearing. Carefully remove drum.

CAUTION: If there is interference between brake shoes and drum, remove hole cover and using a screwdriver and light piece of metal, release brake shoes (Fig. 5).

BRAKE SHOE REMOVAL

(1) Unhook adjusting lever return spring from the lever (Fig. 1). Remove lever and return spring from lever pivot pin. Unhook adjuster lever from adjuster

cable assembly.

(2) Using brake spring pliers (Fig. 6) unhook upper shoe-to-shoe spring. Unhook and remove shoe hold-down springs (Fig. 7).

(3) Disconnect parking brake cable from parking brake lever.

(4) Remove shoes with lower shoe-to-shoe spring and starwheel as an assembly (Fig. 8).

CLEANING AND INSPECTION

Wipe with a water dampened cloth the metal portions of the brake shoes. Examine the lining contact pattern to determine if the shoes are bent. The lining should show contact across the entire width, extending from heel to toe. Shoes showing contact only on one side should be replaced.

Clean the support, using a suitable solvent, then inspect for burrs. Remove if necessary. Clean the threads of the adjusting screws, then inspect for pulled or stripped threads, then apply a thin film of

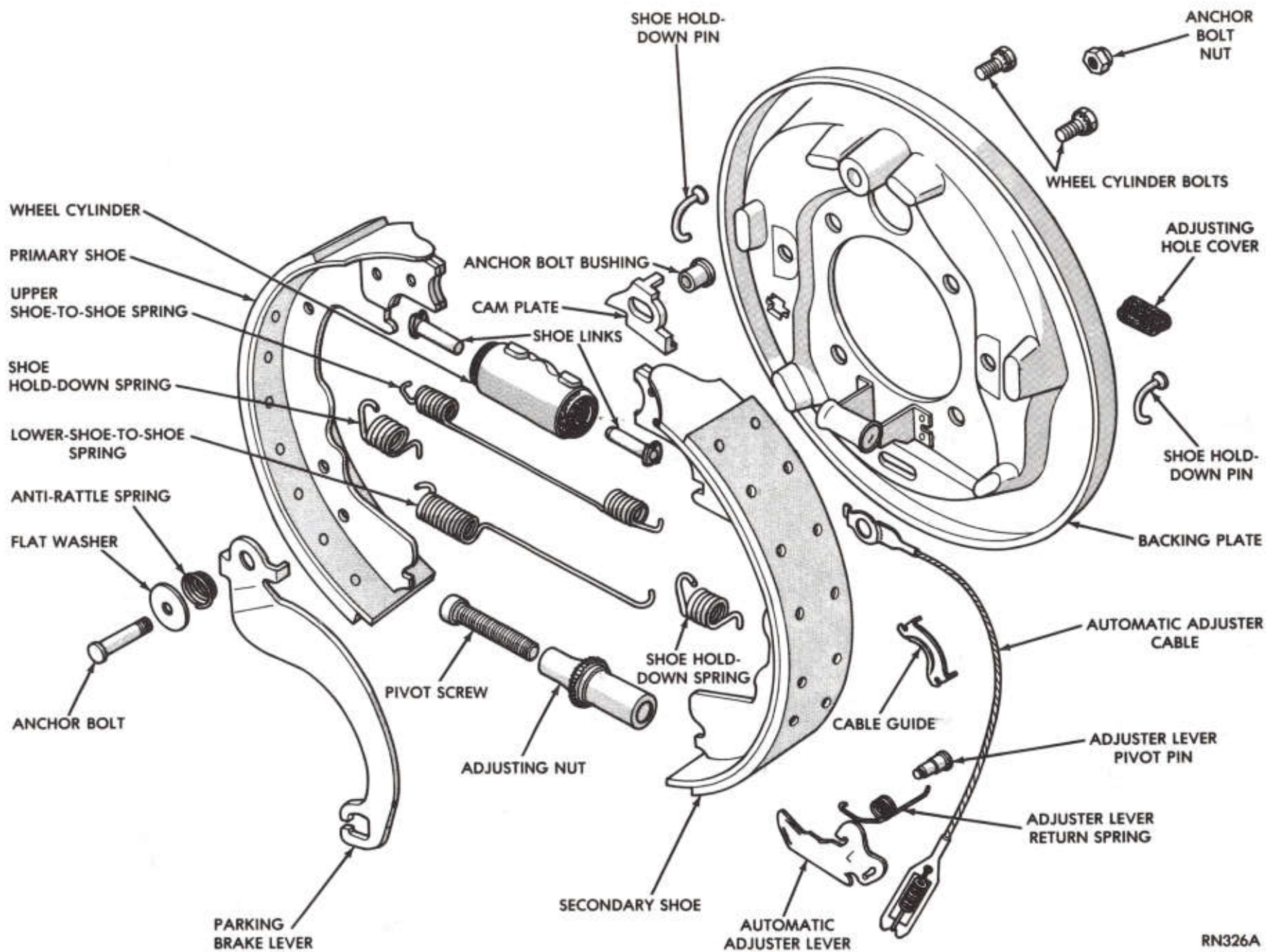


Fig. 1—Rear Brake Assembly

RN326A

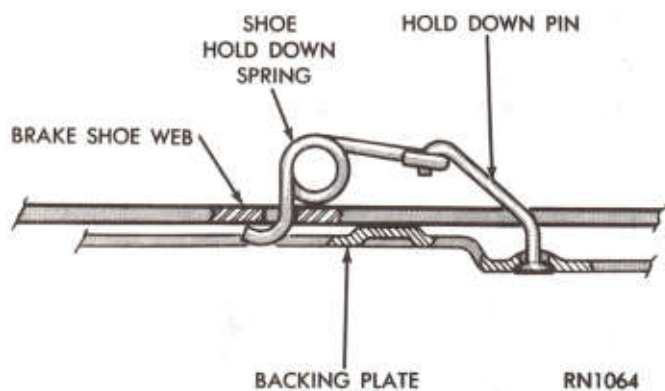


Fig. 2—Coil Spring, Hold-Down Spring Combination

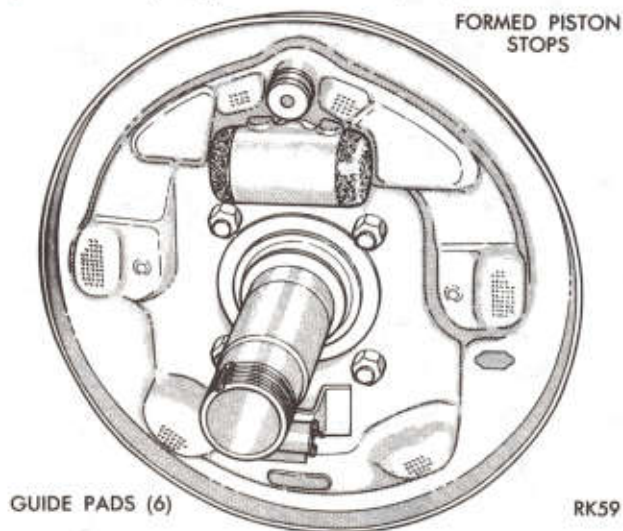


Fig. 3—Support Plate and Guide Pads

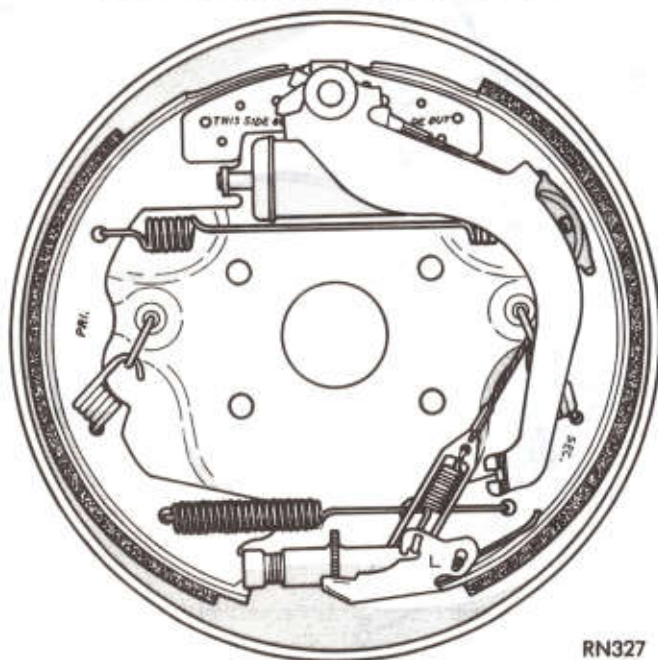


Fig. 4—Rear Brake Assembly

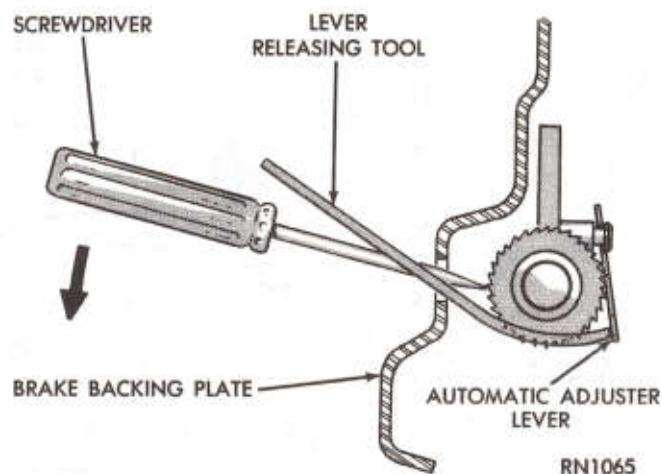


Fig. 5—Releasing Automatic Adjuster

lubricant to the threads, socket and washer. Replace adjuster screw if corrosion of any part inhibits very free operation.

New brake shoe return springs and hold-down springs should be installed where the old springs have been subjected to overheating or if their strength is questionable. Spring paint discoloration or distorted end coils would indicate an overheated spring.

DRUM REFACING

Measure the drum runout and diameter with an accurate gauge. There should be no variation in the drum diameter greater than .004 inch (.09 mm). Drum runout should not exceed .008 inch (.20 mm) out of round. If the drum runout or diameter variation exceed these values the drum should be refaced. For best results in eliminating the irregularities that

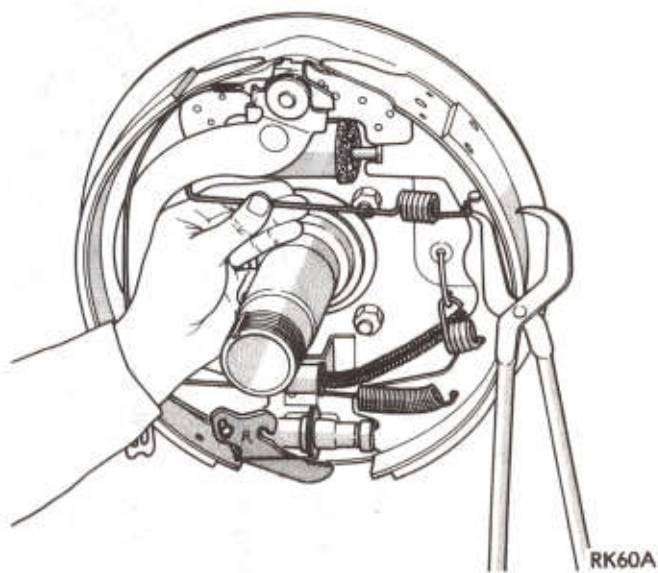


Fig. 6—Removing or Installing Shoe-to-Shoe Spring (Rear)

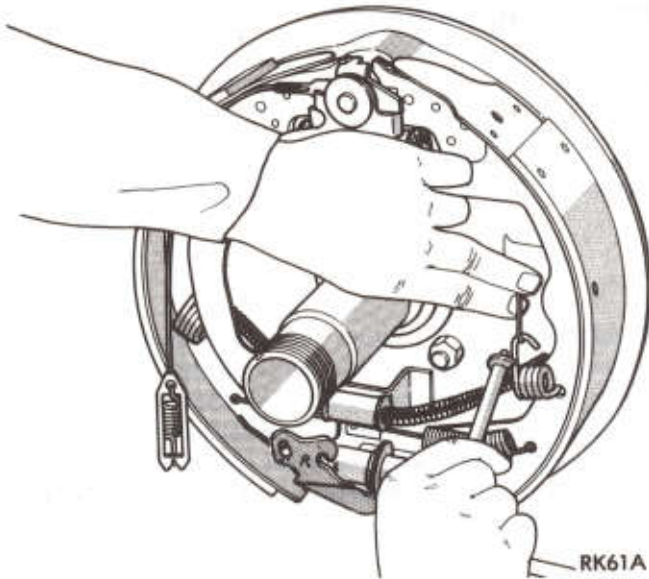


Fig. 7—Removing or Installing Shoe Hold-Down Springs (Rear)

cause brake roughness and surge the amount of material removed during a single cut should be limited to .005 inch (.127mm). When the entire braking surface has been cleaned, a final cut of .001 inch (.025mm) will assure a good drum surface, providing the equipment used is capable of giving the precision required for resurfacing brake drums. Deeper cuts are permissible for the sole purpose of removing deep score marks.

Do not reface more than .060 inch over the standard drum diameter.

All drums will show markings of maximum allowable diameter. For example, a twelve inch (305mm) drum will have a marking of MAX. DIA. 12.090 inch. This marking includes .030 inch (.762mm) for allowable drum wear beyond the recommended .060 inch (1.52mm) of drum refacing.

BRAKE SHOE INSTALLATION

Pivot screw and adjusting nut have left hand threads on left brake assemblies (brakes on left side of the vehicle) and right hand threads on right hand assemblies (brakes on right side of the vehicle).

(1) Lubricate and assemble starwheel assembly. Lubricate guide pads on support plates (Fig. 3) with

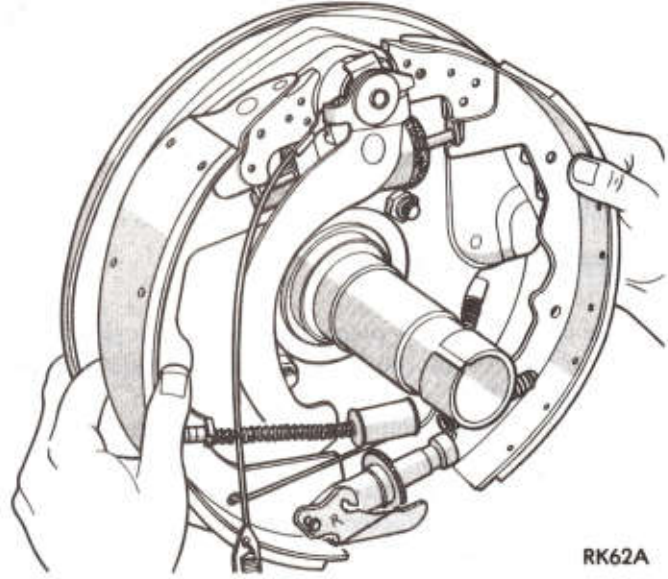


Fig. 8—Removing or Installing Shoe Assembly (Rear)

MOPAR Multi-Purpose Lubricant Part Number 4318063, or equivalent.

(2) Assemble starwheel, lower shoe-to-shoe spring and primary and secondary shoe and position of support plate (Fig. 8).

(3) Connect parking brake cable to parking brake lever.

(4) Install and hook hold-down springs (Fig. 7).

Using brake spring pliers replace upper shoe-to-shoe spring (Fig. 6).

(5) Position adjuster lever return spring on pivot (blue springs on left brakes and white springs on right).

(6) Install adjuster lever. Route adjuster cable and connector to adjuster.

BRAKE DRUM INSTALLATION

(1) Position drum on axle housing.

(2) Install bearing and inner nut. Adjust bearing (See Group 3) in this manual.

(3) Install locking washer and outer nut. Bend locking washer to secure. Place new gasket on hub and install axle shaft, cones, lock washers and nuts.

(4) Install wheel and tire assembly.

(5) Remove jack stands and lower vehicle.

MASTER CYLINDER (Aluminum)

INDEX

	Page		Page
Bleeding Master Cylinder	22	Master Cylinder Removal	22
General Information	22	Reservoir Replacement	22
Installing Master Cylinder	23		

GENERAL INFORMATION

The body of the two-piece master cylinder (Fig. 1), is made of aluminum and the reservoir is made of glass reinforced nylon.

The two compartments of the reservoir are interconnected to permit equalization of the fluid level. However, a sufficient quantity of fluid is retained in the reservoir of the unaffected system to permit operation of that half of the master cylinder even if the other half

of the reservoir is drained due to a hydraulic leak.

The forwardmost outlet tube from the master cylinder is connected to the hydraulic system control valve and then to the **rear brakes**. This system is referred to as the **secondary**. The rearmost outlet tube from the master cylinder is connected to the control valve and the **front brakes**. This system is referred to as **primary**.

SERVICE PROCEDURES

MASTER CYLINDER REMOVAL

- (1) Disconnect primary and secondary brake tubes from master cylinder. Install plugs in the outlets of master cylinder.
- (2) Remove nuts that attach master cylinder to power brake unit.
- (3) Slide master cylinder straight out from power brake unit.

RESERVOIR REPLACEMENT

Before disassembling the master cylinder (Fig. 1) clean outside of reservoir and master cylinder housing.

- (1) Remove reservoir caps and empty the brake fluid from reservoir.
- (2) Position master cylinder in a vise. Grasp reservoir and firmly rock from side to side to remove from master cylinder housing (Fig. 2).
- (3) Remove and discard master cylinder housing to reservoir grommets.

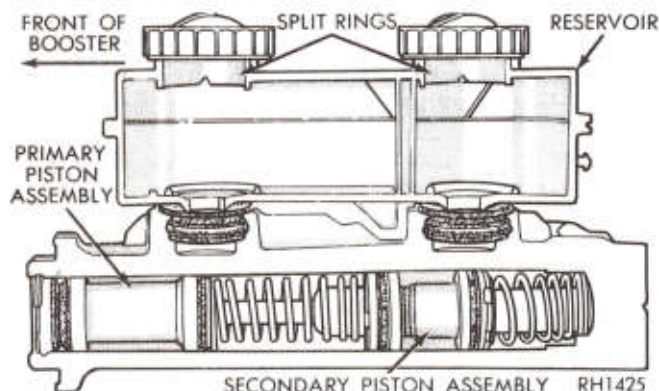


Fig. 1—Aluminum Master Cylinder

- (4) Install new housing to reservoir grommets into master cylinder housing.

- (5) Lubricate reservoir mounting area with clean brake fluid. Place reservoir in position over grommets and using a rocking motion, seat reservoir properly onto master cylinder housing.

CAUTION: Be sure that reservoir is positioned properly! All lettering should be properly read from the left side of the master cylinder. Be sure reservoir seats all the way down until the bottom of the reservoir touches the top of the grommet.

BLEEDING MASTER CYLINDER

Before installing the master cylinder on vehicle, it must be bled on the bench as follows:

- (1) Clamp master cylinder in a vise and attach bleeding tubes Tool C-4029.
- (2) Fill both reservoirs with approved brake fluid.
- (3) Using a brass rod or wood dowel, depress push rod slowly and allow the pistons to return under



Fig. 2—Separating Reservoir from Master Cylinder Housing

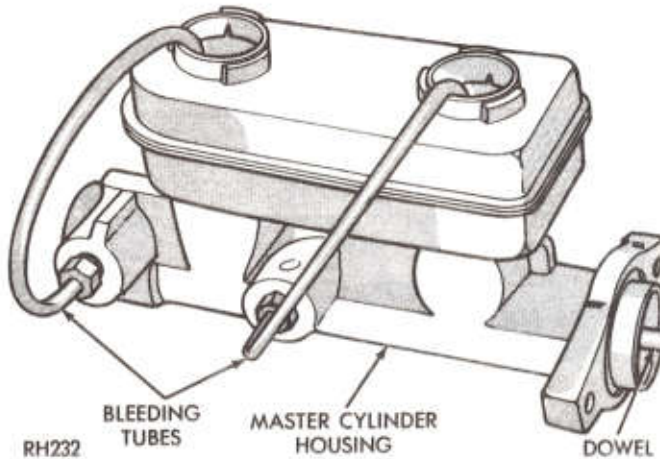


Fig. 3—Bleeding Master Cylinder

pressure of springs. Do this several times until all air bubbles are expelled (Fig. 3).

(4) Remove bleeding tubes from cylinder, plug outlets to prevent spillage and install caps.

(5) Remove from vise and install master cylinder on vehicle.

INSTALLING MASTER CYLINDER

(1) Position master cylinder over studs of power brake unit, aligning power brake push rod with master cylinder piston.

(2) Install and tighten attaching nuts to 200 ± 30 in. lbs. (23 ± 3 N·m).

(3) Connect front and rear brake tubes and tighten to 170 in. lbs. (19 N·m).

(4) Bleed brakes using normal procedure, being sure fluid level in master cylinder is maintained. (See Bleeding the Brake System in "Service Adjustments".)

MASTER CYLINDER (CAST IRON)

INDEX

	Page		Page
Bleeding Master Cylinder	24	Installing Master Cylinder	24
General Information	23	Master Cylinder Removal	23

GENERAL INFORMATION

The cast iron master cylinder (Fig. 1) is of the venting type with reservoirs cast integrally. It consists of a primary and secondary piston (in tandem) with outlet tubes from the master cylinder connected to the

hydraulic system warning switch valve and then from the primary switch port to the front brakes and from the secondary port to the rear brakes.

SERVICE PROCEDURES

MASTER CYLINDER REMOVAL

(1) Disconnect primary and secondary brake tubes from master cylinder.

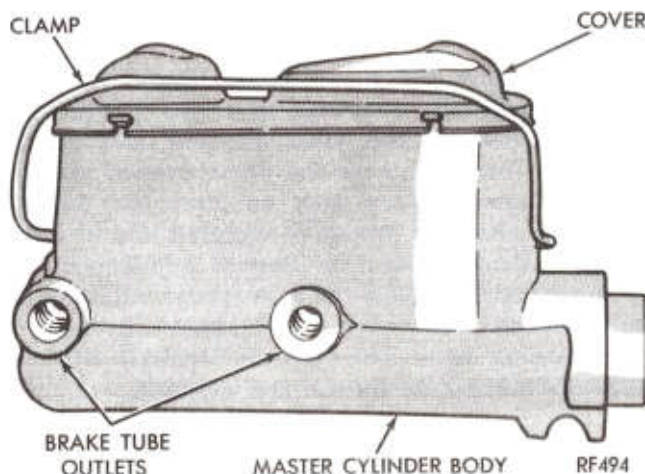


Fig. 1—Cast Iron Master Cylinder Assembly

(2) Remove nuts attaching master cylinder to power brake unit.

(3) Slide master cylinder straight out from power brake unit.

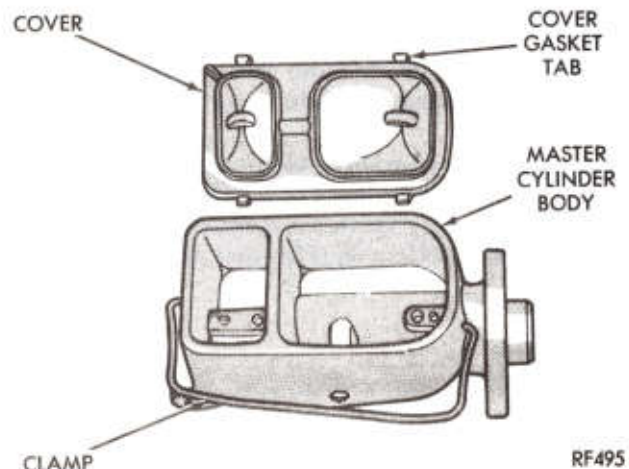


Fig. 2—Cast Iron Master Cylinder Assembly

BLEEDING MASTER CYLINDER

Before installing master cylinder on vehicle, it must be bled on bench as follows:

- (1) Clamp master cylinder in a vise and attach bleeding tubes Tool C-4029.
- (2) Fill both reservoirs with approved brake fluid.
- (3) Depress temporary push rod slowly and allow the pistons to return under pressure of springs. Do this several times until all air bubbles are expelled.
- (4) Remove bleeding tube from cylinder and install gasket and cover (as tubes are removed fluid remaining in tube will syphon out).
- (5) Install cover clamp and remove master cylinder from vise.

INSTALLING MASTER CYLINDER

- (1) Position master cylinder on vehicle.
- (2) Install attaching nuts, tighten to 200 in. lbs. (23 N·m). Connect push rod to brake pedal linkage.

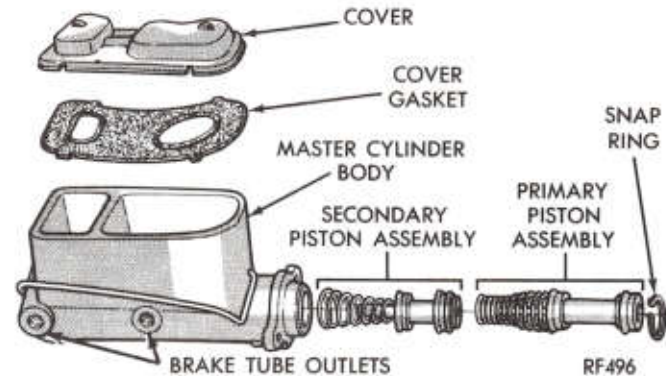


Fig. 3—Cast Iron Master Cylinder Assembly

(3) Connect front and rear brake tubes and tighten to 170 in. lbs. (19 N·m).

(4) Bleed brakes using normal procedure, being sure fluid level in master cylinder is maintained. (See Bleeding the Brake System in "Service Adjustments").

HYDRAULIC SYSTEM CONTROL VALVES

INDEX

	Page
General Information	24
Brake Warning Switch Operation	24
Hold-Off Unit Operation	25
Proportioning Unit Operation	25
Service Procedures	26
Brake Warning Switch	26

	Page
Checking The Brake Warning Switch Unit ...	26
Hold-Off Valve	26
Checking The Hold-Off Valve	26
Proportioning Valve	26
Testing The Proportioning Valve Unit	26
Valve Application Chart	25

GENERAL INFORMATION

All models have a hydraulic system control valve in the brake system (Figs. 1 and 2). The valve is mounted on the frame rail below the master cylinder.

The control valve assembly on some models combines a brake warning switch with a hold-off and proportioning valve assembly (Fig. 1). A brake warning switch and hold-off valve assembly are combined and used on other models (Fig. 2).

Hold-off and Proportioning valves are used because of different braking characteristics between disc and drum brakes.

There is only one valve assembly in each vehicle, see "Valve Application Chart." During any service procedures identify valve assemblies by part number as well as hold off/cut in (PSI) and split point (PSI).

Brake Warning Switch Operation

The hydraulic system brake warning switch warns the vehicle operator that one of the hydraulic systems has failed. A failure in one part of the brake system does not result in failure of the entire hydraulic brake system. As an example, failure of the rear brake system will leave the front brake system still operative.

If a pressure loss occurs in one side of the dual brake system, the difference in pressure causes the piston to move to the failed side and latch in that position. This will cause the brake system warning light to come on and stay on after the pedal is released. After the system is repaired and bled (see Bleeding Brake System in "Service Adjustments"), a moderate application of the brake pedal will hydraulically recenter the piston and automatically turn off the warning light. **THE VALVE SHOULD NOT BE DISASSEMBLED TO RESET THE PISTON.**

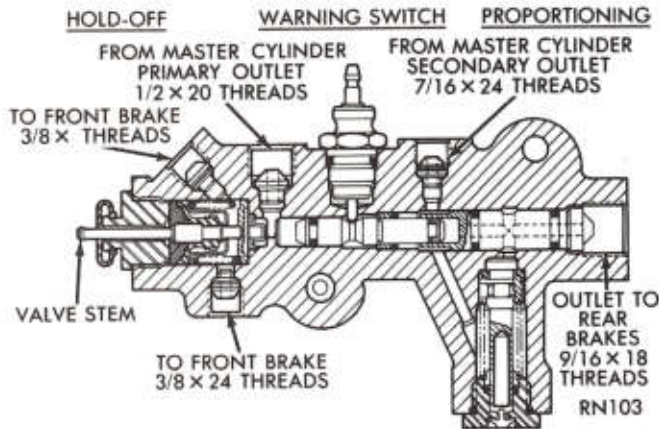


Fig. 1—Combination Warning Switch/Hold-Off/Proportioning Valve Assembly

Proportioning Unit Operation

The proportioning valve section operates by transmitting full input pressure to the rear brakes up to a certain point, called the split point, and beyond that point it reduces the amount of pressure increase to the rear brakes according to a certain ratio.

Thus, on light pedal applications, approximately equal brake pressure will be transmitted to the front and rear brakes, while at higher pressures, the pressure transmitted to the rear brakes will be lower than to the front brakes to prevent premature rear wheel lock-up and skid.

If hydraulic pressure is lost in the front brake system, rear brake system hydraulic pressure moves the brake warning switch piston and opens a bypass in the proportioning unit allowing full rear brake hydraulic pressure.

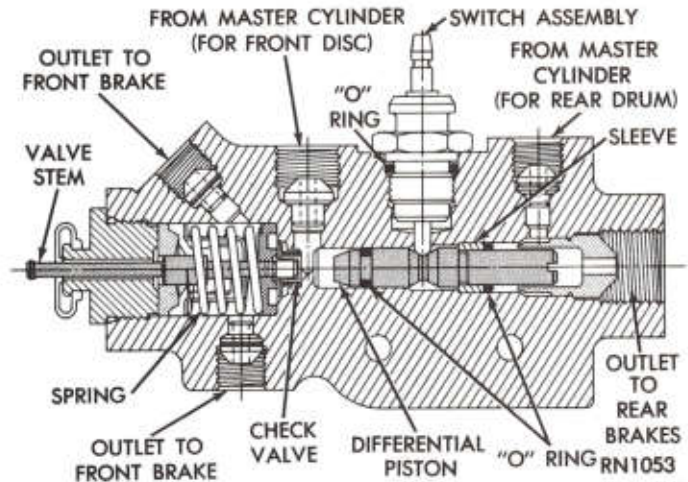


Fig. 2—Brake Warning Switch/Hold-Off Valve

Hold-Off Unit Operation

The hold-off valve section holds off pressure to the front disc brakes to allow the rear drum brake shoes to overcome the return springs and begin to contact the drums. This valve keeps the output pressure to the front brakes in the 3 to 30 psi range until the hold-off pressure is reached (117 psi) and then blends back to give full output pressure to the front brakes under heavy brake applications. This feature helps to prevent the front brakes from locking under light pedal application when driving on icy surfaces. The hold-off valve has no effect on front brake pressure during hard stops.

VALVE APPLICATION CHART

Vehicle Line	Brake Type	Hydraulic Valve Type	Hold-Off Cut-In (PSI)	Split Point (PSI)/Slope	*Identification Tag
D150, AD150, W150, AW150	Disc	W/P/H	117	300/.27	White
D250, D350, W250, W350	Disc	W/H	117	—	Black

W/P/H Brake Warning, Proportioning, Hold-Off Valve Assembly
*Colored tag under valve stem boot

W/H Brake Warning, Hold-Off Valve Assembly

SERVICE PROCEDURES

BRAKE WARNING SWITCH

Checking The Brake Warning Switch Unit

The brake warning light is lit only when the parking brake is applied with the ignition key turned "ON". The same light will also illuminate should one of the two service brake systems fail.

To test the service brake warning system, raise the car on a hoist and open a wheel cylinder bleeder while a helper depresses the brake pedal and observes the warning light. If the light fails to light, inspect for a burned out bulb, disconnected socket, or a broken or disconnected wire at the switch. If the bulb is not burned out and the wire continuity is uninterrupted, check the service brake warning switch operation with a test lamp between the switch terminal and a voltage source.

If light still fails to light, disconnect the brake tubes from the valve assembly and install a new valve assembly. If a new valve is installed, bleed the system. **The warning switch is not serviced separately. Do not remove the switch or attempt to repair.**

After repairing and bleeding the brake system (see "Bleeding Brake System" in service adjustments), applying the brakes with moderate force will hydraulically recenter the piston and automatically turn off the warning light. **DO NOT DISASSEMBLE TO RESET THE PISTON.**

HOLD-OFF VALVE

Checking the Hold-Off Valve

A visual check will show that the valve stem extends slightly when the brakes are applied and retracts when the brakes are released.

In case of a hold-off valve malfunction, remove the valve and install a new combination valve assembly. **CAUTION: See Bleeding Brake System in "Service Adjustments" this group, before any attempt to bleed the hydraulic system on vehicles equipped with hold-off valves.**

PROPORTIONING VALVE

Testing The Proportioning Valve Unit

When a premature rear wheel slide is obtained on brake application, it could be an indication that the fluid pressure to the rear brakes is above the reduction ratio for the rear line pressure and that a malfunction has occurred within the proportioning valve unit which should be tested.

To test the proportioning valve, proceed as follows:

During testing, leave front brake lines connected to the valve.

(1) Install one gauge and "T" of set C-4007A between brake line from master cylinder secondary port and brake valve assembly (Fig. 3).

(2) Install the second gauge of set C-4007A to the rear brake outlet port between valve assembly and the rear brake line. (An adapter tube, made up locally of a 9/16 x 18 tube nut, short piece of brake tube and 3/8 x 24 tube nut will be required to connect the hose to the valve). Bleed the rear brake system.

(3) Have a helper exert pressure on the brake pedal (holding pressure) to get a reading on the valve inlet gauge and check the reading on the outlet gauge. If the inlet and outlet pressures do not agree with the values on the following chart, replace the valve.

(4) Valve assemblies for all models are shipped in the front failed position to improve bleeding. When installing a new valve, bleed the rear brakes first (see Bleeding Brake System in "Service Adjustments", this group). After bleeding both front and rear systems, applying the brakes with moderate force will hydraulically reset the switch and turn off the warning light.

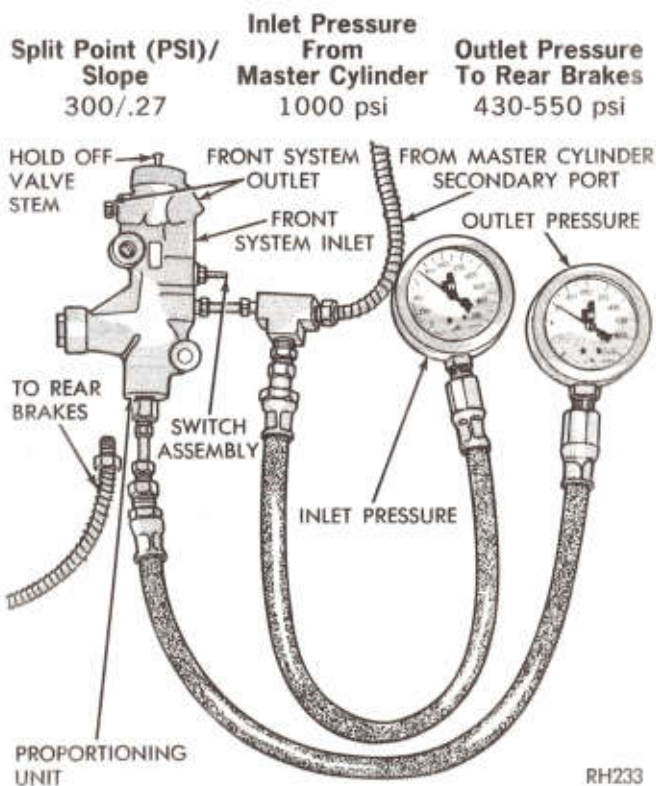


Fig. 3—Testing Proportioning Section of Combination Valve

RH233

PARKING BRAKES

INDEX

	Page		Page
General Information	27	Intermediate Cable Replacement	27
Parking Brake Adjustment	27	Rear Cable Replacement	27
Front Cable Replacement	27	Specifications	61

GENERAL INFORMATION

The rear wheel brakes also act as parking brakes. The rear brake shoes are mechanically operated by a lever and strut that are connected to a flexible steel cable. The wheel brake cables are joined together by an

equalizer and front cable extending to the parking brake pedal. (Fig. 1). Refer to "Service Brakes" Group 5 for brake shoe removal and installation procedures.

SERVICE PROCEDURES

PARKING BRAKE ADJUSTMENT

The service brakes must be properly adjusted before adjusting parking brake. Refer to "Service Brake" Group 5.

- (1) Release the parking brake pedal and loosen cable adjusting nut to insure cable is slack.
- (2) Adjust service brakes.
- (3) Tighten cable adjusting nut until a slight drag is felt while rotating the wheel. Loosen cable adjusting nut until both rear wheels can be rotated freely, then back off cable adjusting nut two full turns.
- (4) Apply parking brake several times, then release and test to see that the rear wheels rotate freely without dragging.

REAR CABLE REPLACEMENT

Removal

The independent wheel brake cables are attached to an equalizer. The front cable is adjusted at the adjusting link.

- (1) Remove adjusting nut at adjusting link.
- (2) With vehicle jacked up or on a suitable hoist, remove rear wheels.
- (3) Remove brake drums from rear axle.
- (4) Remove brake shoe return springs.
- (5) Remove brake shoe retaining springs.
- (6) Remove brake shoes, strut and spring from brake support plate and disconnect brake cable from operating arm.
- (7) Compress retainers on end of brake cable housing and remove cable from brake plate.
- (8) Remove retaining clip at anchor.
- (9) Disconnect brake cable from the equalizer.

Installation

- (1) Insert brake cable and housing into anchor and install retaining clip.
- (2) Insert brake cable and housing into brake support plate making certain the housing retainers lock housing firmly into place.

(3) Holding brake shoes (and strut, if so equipped) in place on the support table, engage brake cable into brake shoe operating lever.

- (4) Install brake shoe retaining springs, and brake shoe return springs.
- (5) Insert front of brake cable into the equalizer.
- (6) Install brake drum and wheel.
- (7) Adjust service brakes and parking brake cable.

FRONT CABLE REPLACEMENT

Removal

- (1) Remove adjusting nut at adjusting link.
- (2) Disengage cable housing at lower anchor point and remove cable and housing from bracket.
- (3) Remove cable housing retaining clip at parking brake lever.
- (4) Remove retaining clip from lever.
- (5) Remove end of cable from clevis.
- (6) Remove housing grommet from floor pan.

Installation

- (1) Insert cable and housing through floor pan and install housing grommet.
- (2) Install retainer clip at upper end of cable housing and engage cable end in slot of lever clevis.
- (3) Engage cable housing at lower anchor bracket and install clip.
- (4) Connect cable at adjusting link by installing adjusting nut.
- (5) Adjust service brakes and parking brake cable.
- (6) Apply brakes several times and test for free wheel rotation when parking brake is in the "off" position.

INTERMEDIATE CABLE REPLACEMENT

Removal

- (1) Remove adjusting nut at adjusting link.
- (2) Disengage rear end of cable from ratio lever or cable equalizer and remove.

Installation

Reverse removal procedures.

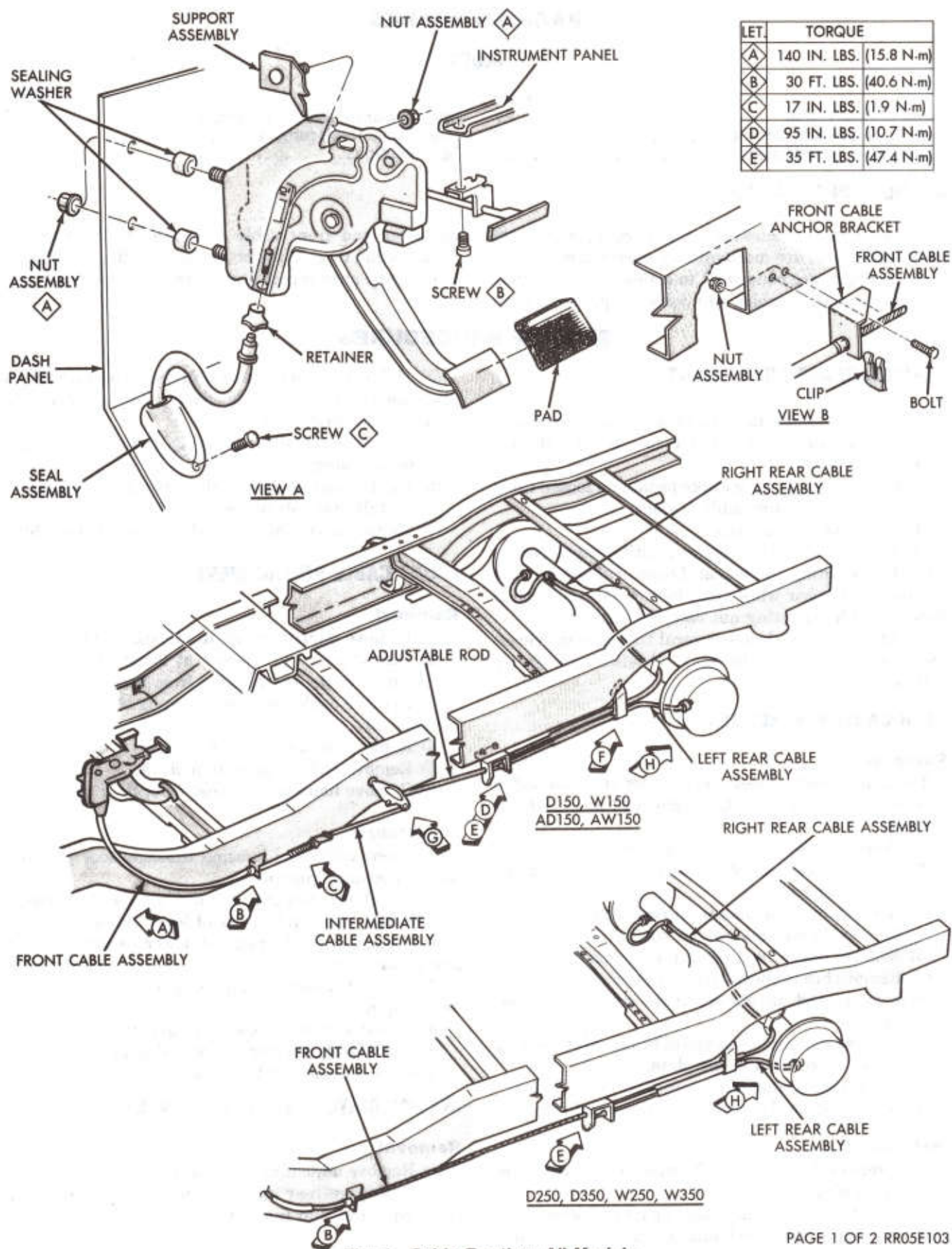
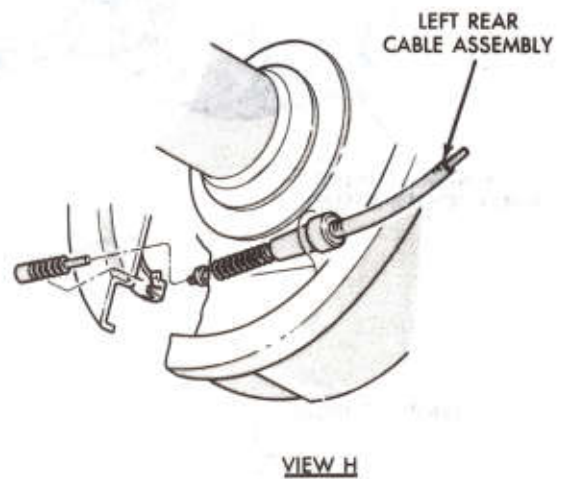
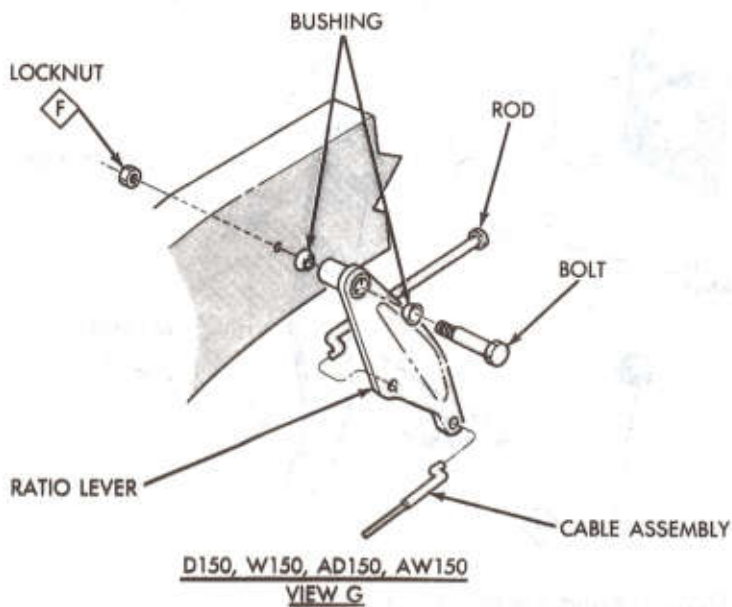
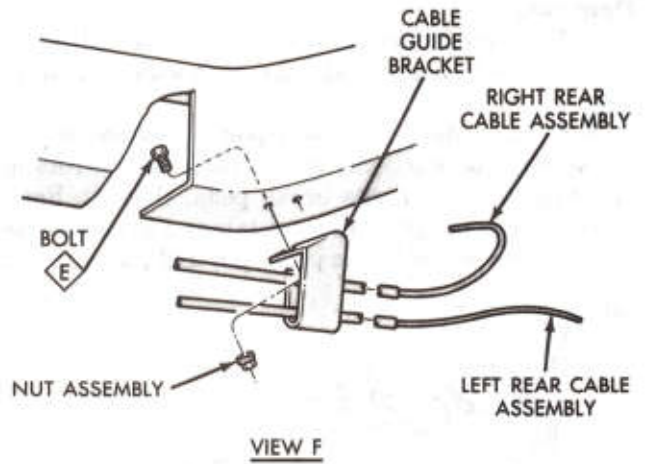
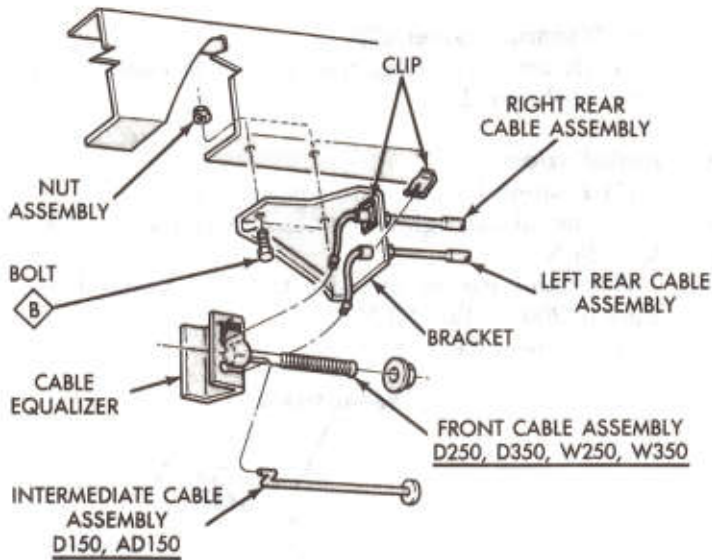
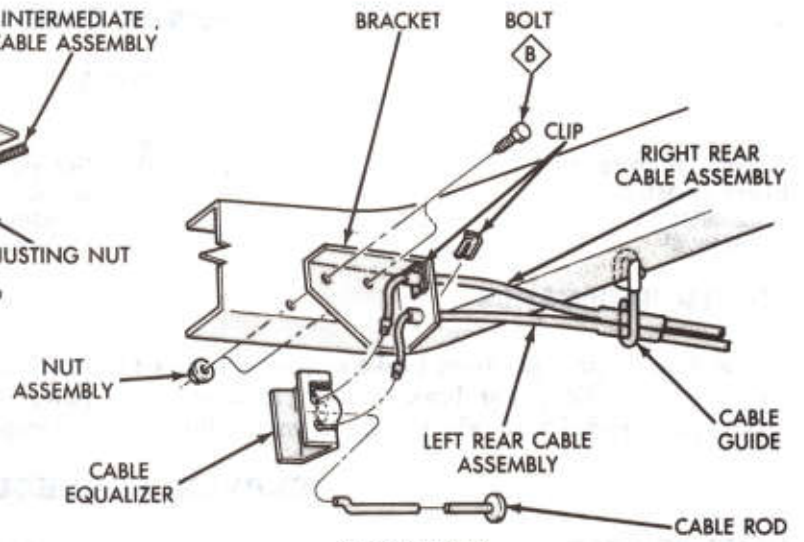
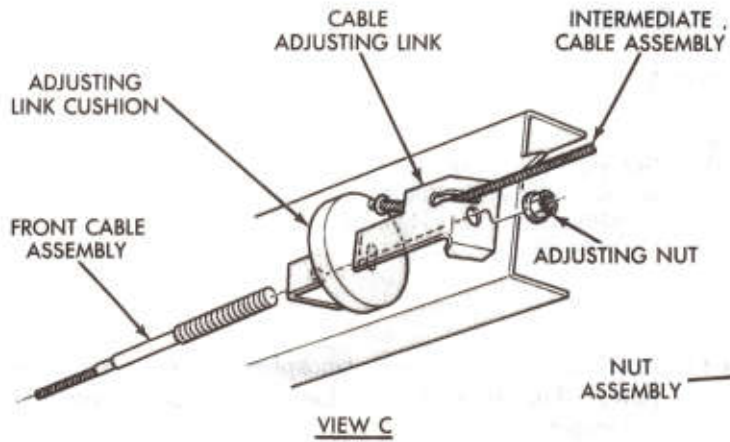


Fig. 1—Cable Routing, All Models



POWER BRAKE

INDEX

	Page		Page
General Information	30	Service Procedures	30
Brake Booster		Brake Pedal and Linkage	31
Installation	30	Installation	31
Removal	30	Removal	31

GENERAL INFORMATION

The diaphragm type power brake is a self-contained vacuum hydraulic power braking unit. It is of the vacuum suspended type which utilizes engine intake

manifold vacuum and atmospheric pressure for its power. This type of unit does not require a vacuum reservoir.

SERVICE PROCEDURES

BRAKE BOOSTER

Removal

- (1) Disconnect vacuum hose from check valve.
- (2) Remove master cylinder to booster mounting nuts.
- (3) From under instrument panel, position a small screwdriver between the center tang on the retainer clip and the pin in the brake pedal (Fig. 1). Rotate screwdriver enough to allow retainer clip center tang to pass over end of brake pedal pin and pull clip from

pin. **Discard retainer clip.**

- (4) Remove mounting nuts and slide booster away from dash panel.

Installation

- (1) Position booster onto dash panel.
- (2) Install and tighten four mounting nuts to 220 in. lbs. (25 N·m).
- (3) Install master cylinder to booster and tighten nuts to 200 in. lbs. (23 N·m).
- (4) Connect vacuum hose.

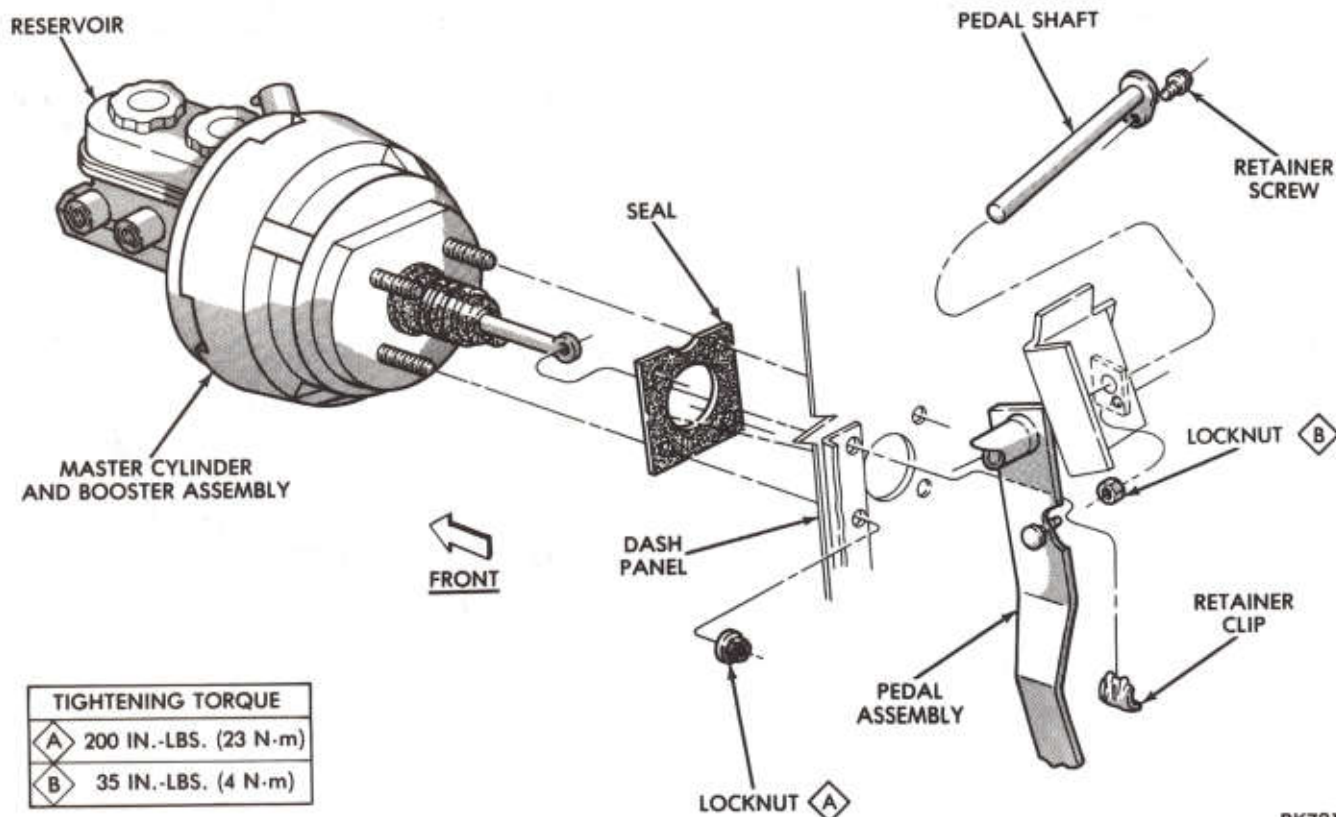


Fig. 1—Power Brake Mounting and Related Parts

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(5) Connect push rod to pedal pin and install **new retainer clip**.

(6) Check stop lamp operation and readjust if necessary.

CAUTION: Do not attempt to disassemble brake booster as this unit will be serviced by Manufacturer's Service Station.

BRAKE PEDAL AND LINKAGE

Removal

(1) From under instrument panel, position a small screwdriver between the center tang on the retainer clip and the pin in the brake pedal (Fig. 1). Rotate screwdriver enough to allow retainer clip center tang

to pass over end of brake pedal pin and pull clip and push rod from pin. **Discard retainer clip.**

(2) Remove retainer screw and locknut from end of pedal shaft (Fig. 1).

(3) Slide pedal shaft out of housing and remove brake pedal assembly.

Installation

(1) Position brake pedal assembly and slide pedal shaft into position.

(2) Install retainer screw and tighten locknut to 35 in. lbs. (4 N·m).

(3) Connect push rod to pedal pin and install **new retainer clip**.

DISC BRAKE—CHRYSLER (D150, D250, D350, AD150)

INDEX

	Page
Assembling Caliper	38
Bleeding Disc Brake	39
Brake Shoe Installation	35
Brake Shoe Removal	35
Cleaning and Inspection	35
Disassembling Caliper	37

	Page
General Information	31
Hold-Off Valves	34
Installing Caliper	38
Removing Caliper from Vehicle	36
Routine Maintenance	34
Specifications	61

GENERAL INFORMATION

The single piston sliding caliper disc brake assembly (Fig. 1), consists of the hub and disc assembly, the caliper, shoes and linings, splash shield and adaptor.

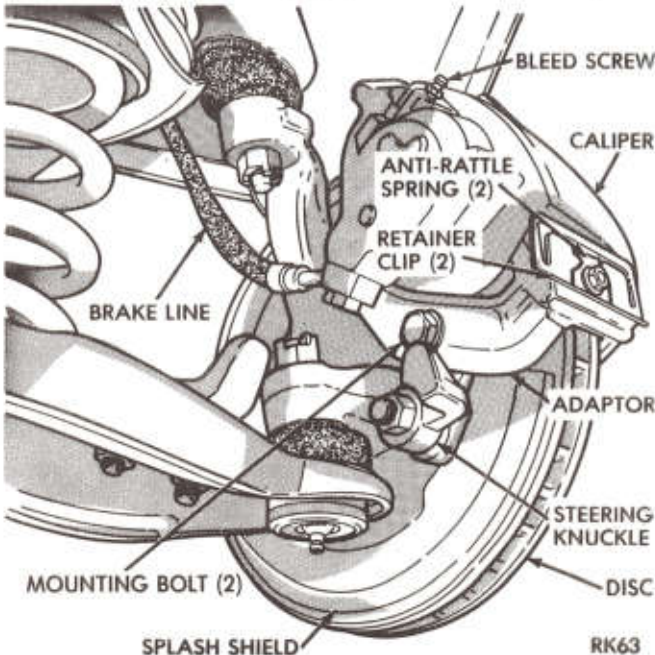


Fig. 1—Single Piston Sliding Caliper Assembly (Rear View)

The cast iron braking disc has cooling fins or louvers that are cast integrally between the two machined braking surfaces (Fig. 2).

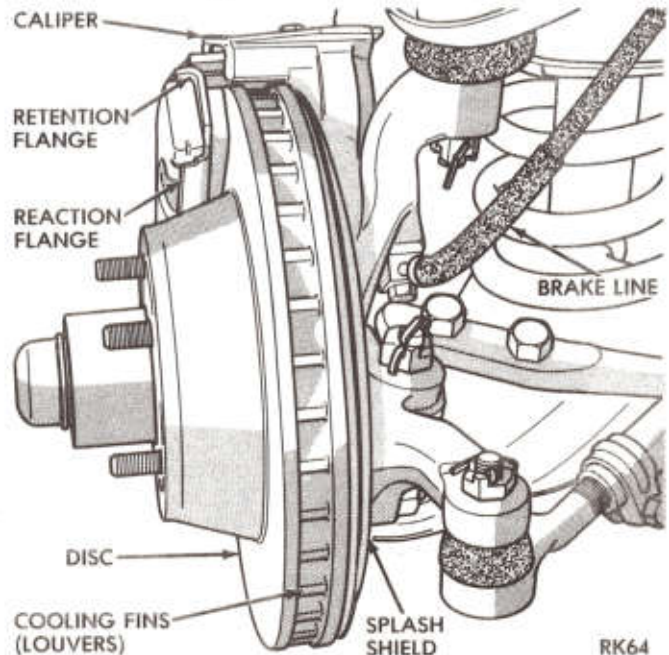


Fig. 2—Sliding Caliper Assembly (Front View)

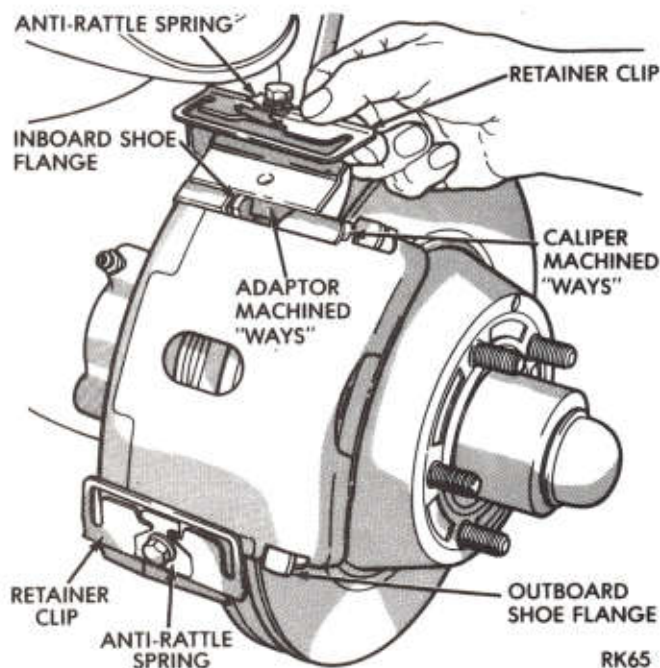


Fig. 3—Adapter and Caliper Machined "Ways" and Caliper Retention

When the wheel is in motion, the rotation of the disc cooling fins supplies air circulation between the braking surfaces for efficient cooling of the disc and prolonged lining life. The braking disc is protected from road splash (inboard side) by a shield bolted to the steering knuckle and by the wheel and tire on the outboard side (Fig. 2).

Two machined abutments on the adaptor position and align the caliper. The retaining clips retain the caliper in the machined guides or "ways" on the adaptor and allow lateral movement of the caliper (Fig. 3).

Flanges on the outboard shoe (Fig. 2) are used to radially locate and position the shoe on the caliper fingers. The inboard shoe is held in a captive position by the adaptor (Fig. 8). All braking force on the outboard shoe is taken by the caliper. The inboard shoe reacts directly on the adaptor.

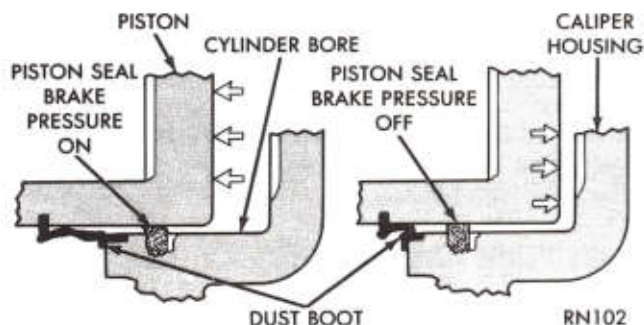


Fig. 4—Piston Seal Function for Automatic Adjustment

The caliper is a one piece casting with the inboard side containing the single piston cylinder bore. A phenolic piston is used.

The square cut rubber piston seal is located in a machined groove in the cylinder bore and provides a hydraulic seal between the piston and the cylinder wall (Fig. 5). The adaptor is mounted to the steering knuckle by two special nylock bolts (Figs. 1 and 5).

A press in moulded rubber dust boot keeps contamination from the cylinder wall and piston.

As the brake pedal is depressed, hydraulic pressure is applied against the piston. This force is transmitted to the inboard brake shoe and lining and the inboard braking surface of the disc. As force increases against the disc from the inner lining, the caliper assembly moves inboard, sliding on the machined adaptor "ways" (Fig. 3), thus providing a clamping force on the disc.

When the brake pressure is released, the piston seal (distorted by applied pressure) returns to its normal position, pulling the piston back to released position (Fig. 4), creating a slight running clearance between inner shoe and the disc.

Automatic adjustment is obtained by outward relocation of the piston as the inboard lining wears and the inward movement of the caliper as the outboard lining wears, thus maintaining correct adjustment at all times.

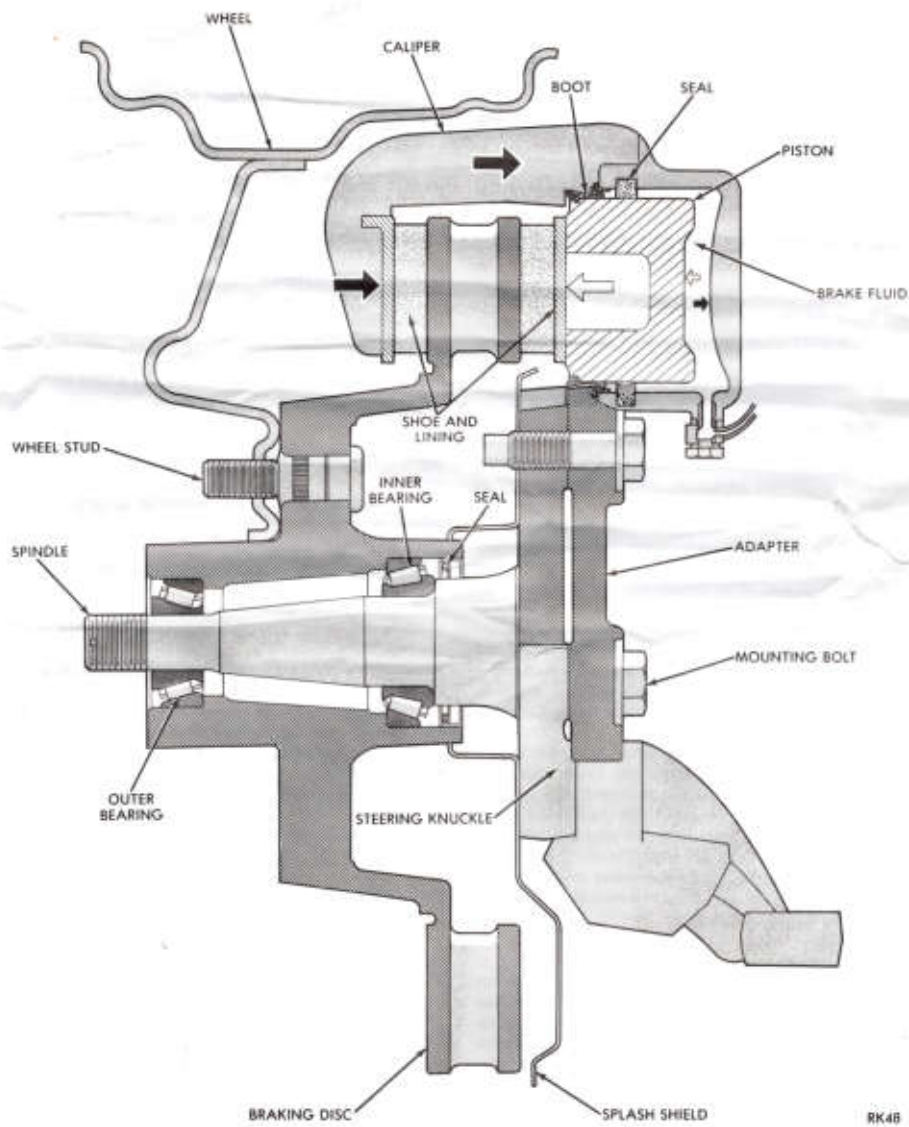


Fig. 5—Disc Brake Assembly

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DISC BRAKE SERVICE PRECAUTIONS

(1) The master cylinder fluid level should be checked frequently, **AT LEAST EVERY** Engine Oil change. Maintain fluid level to within 1/4 inch of the top of the reservoir. Use only clean brake fluid conforming to DOT 3 specifications.

(2) Linings should maintain light contact with the disc or have no more than .005 inch clearance. However, if the truck was braked to a stop shortly before checking clearance, it is normal for the brakes to drag. If the linings are more than .005 inch from the disc, apply the brakes several times and recheck the clearance.

(3) "Knock-back" of the linings can be caused by the normal deflection of front suspension components during a hard turn. In effect, the disc is tilted and knocks the linings and pistons back. Excessive running clearance results and the driver will notice increased pedal travel on the next brake application. Loose or worn suspension parts, especially front wheel bearings, can increase the problem and cause the driver to pump the pedal several times to get braking action. Check and adjust or replace loose, worn or broken parts.

(4) Lining wear should be checked at least every 10,000 miles (16090 km) under normal operating conditions. If operating conditions are severe, lining wear should be checked more frequently.

(5) Lack of parallelism between the two faces of the disc, (variations in the disc thickness) may cause excessive pedal travel, a thrumming sound (front end vibration) or a pumping (up-and-down movement) of the brake pedal when braking a moving truck. Disc thickness must be checked if these symptoms are present.

(6) Disc lateral runout is "wobble" from side to side and can cause linings and pistons to be "knocked back" causing increased pedal travel. If the disc wobbles slightly when rotated, even though the wheel bearings are in good condition and properly adjusted, the wobble will usually not affect braking efficiency. Disc lateral runout should be checked whenever major service procedures are required on a sliding caliper disc brake system.

Brake Roughness

The most common cause of brake roughness (or chatter) with disc brakes is excessive variation in disc thickness. This can be easily checked with a 2 in. micrometer (vernier type preferred). If the measurement is out of specification, the disc must be refin-

ished or replaced. Refer to "Refinishing (Refacing) Braking Disc" paragraph.

Other less prevalent causes of roughness can be the use of some types of non-standard lining and extreme abrasion of the disc faces. Also, vehicles which stand unused for periods of time in areas of high humidity or salt air may incur rust on the disc which could cause a temporary brake surge and roughness. Normally however, this condition should correct itself after a short period of usage. If rust is severe enough roughness will not clear up and the disc must be resurfaced or replaced.

ROUTINE MAINTENANCE

Check Brake Lines, Hoses and Linings

Raise all four wheels. Remove front wheel and tire assemblies and inspect the braking disc, linings and caliper. Inspect brake flexible hose and tubing according to procedure outlined in "Brake Hose and Tubing", this Group (The wheel bearings should be inspected at this time and replaced if necessary). **The caliper assembly must be removed in order to inspect the inner wheel bearings.** (Refer to "Brake Shoe Removal" paragraph).

Do not get oil or grease on the braking disc or linings. If the linings (pads) are worn to within .030 inch (.762mm) of the shoe, or rivets, replace both sets of shoe and lining assemblies, (inboard and outboard) on the front wheels. It is necessary that both front wheel sets be replaced whenever a respective shoe and lining is worn beyond specifications or damaged.

Check all brake tube connections for possible leaks. Install new flexible hoses as required.

Check adapter plate to knuckle bolts for specified torque as follows.

110 foot pounds (149 N-m) for D150, D250, AD150 models.

160 foot pounds (216.9 N-m) for D250 H.D., D350 models.

HOLD-OFF VALVES

All sliding caliper disc brakes are equipped with combination brake warning/Hold-off valve (See "Hydraulic System Control Valves," this Group). The Hold-off unit of the combination valve is to better match the front disc brakes with the rear drum brakes on the vehicle. This results in improved braking and steering control.

SERVICE PROCEDURES

BRAKE SHOE REMOVAL

- (1) Raise vehicle on a hoist or jackstands.
- (2) Remove front wheel covers, and wheel and tire assemblies.
- (3) Remove caliper retaining clips and anti-rattle springs (Fig. 3).
- (4) Remove caliper from disc by slowly sliding caliper assembly out and away from disc (Fig. 6).
- (5) Remove outboard shoe (flanges on outboard shoe will retain shoe to caliper) by prying between shoe and caliper fingers (Fig. 7). Support caliper so as not to damage flexible brake hose. Remove inboard brake shoe (Fig. 8).

CLEANING AND INSPECTION

Check for piston seal leaks (evident by brake fluid in and around boot area and inboard lining) and for any ruptures of piston dust boot. If boot is damaged, or fluid is evident, it will be necessary to disassemble caliper assembly and install a new seal, boot, (and piston if damaged or corroded (Fig. 9)). (Refer to "Disassembling Caliper Assembly" paragraph). Check the mating surfaces of the abutments on the caliper and adaptor. If corroded or rusty, clean surfaces with wire brush. Inspect braking surfaces of disc.

BRAKE SHOE INSTALLATION

- (1) Slowly and carefully push piston back into bore until it is bottomed. Watch for possible reservoir overflow.
- (2) Slide new outboard shoe and lining assembly in recess of caliper after removing paper from noise

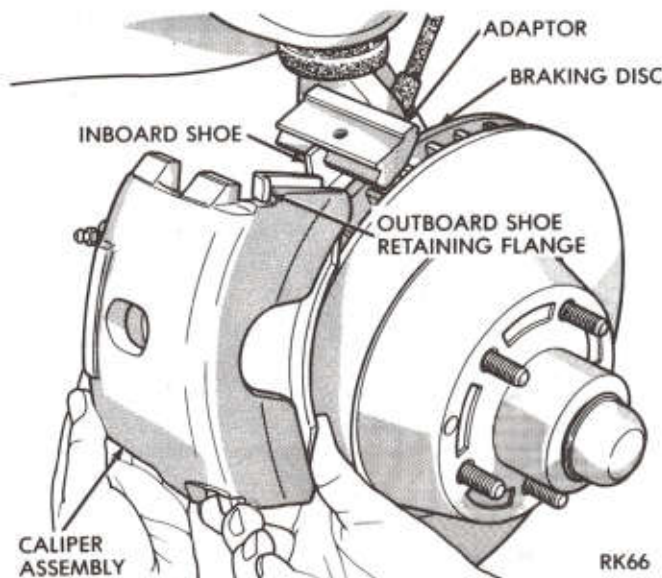


Fig. 6—Removing or Installing Caliper

suppression gasket.

CAUTION: No free play between brake shoe flanges and caliper fingers (Fig. 10) should exist (which might cause brake shoe rattle).

If free play is evident by vertical shoe movement after installation, remove shoe from caliper and bend flanges (Fig. 11) to create slight interference fit to eliminate all vertical free play when shoe is installed. Install shoe after above modification, if necessary, by snapping shoe into place with fingers or with light "C" clamp, protect new lining from damage or con-

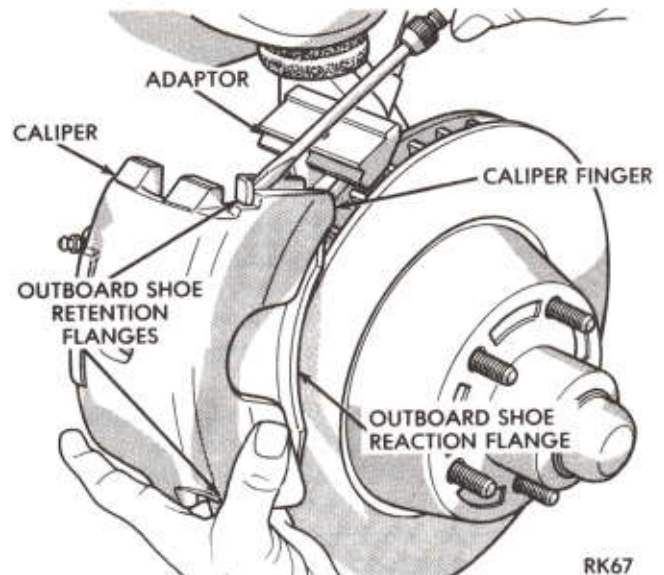


Fig. 7—Removing Outboard Shoe

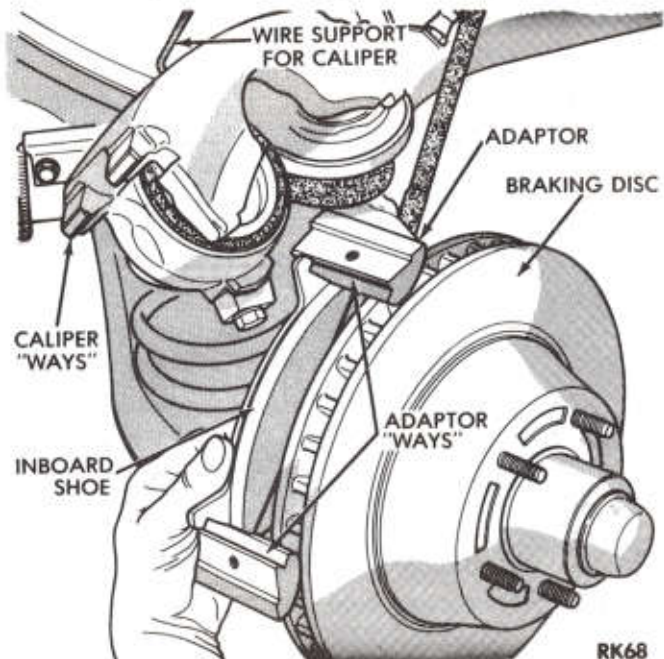


Fig. 8—Removing or Installing Shoe

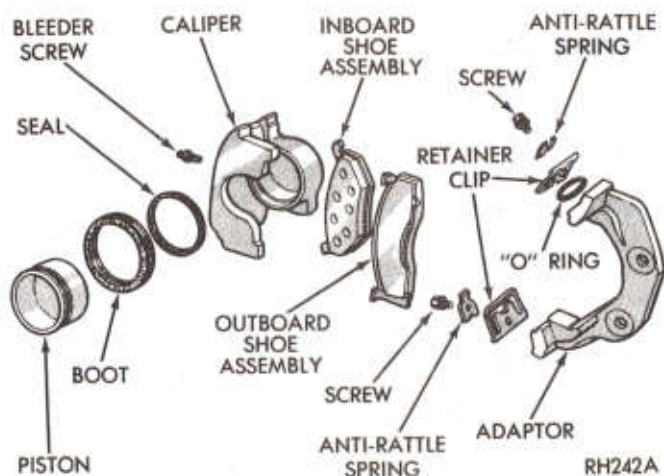


Fig. 9—Caliper Assembly

tamination by using old pads over new lining and across caliper fingers (Fig. 12).

(3) Remove paper from noise suppression gasket and then position inboard shoe in position on adaptor with shoe "flanges" in the adapter "ways" (Fig. 8).

(4) Slowly slide caliper assembly into position in adaptor and over disc. Align caliper on machined ways of adaptor. Be careful not to pull the dust boot from its groove as the piston and boot slide over the inboard shoe.

(5) Install anti-rattle springs and retaining clips and torque retaining screws to 200 in. lbs.

The inboard shoe anti-rattle spring must **always** be installed on **top** of the retainer spring plate. (Fig. 4).

(6) Pump brake pedal several times until a firm pedal has been obtained.

(7) Check and refill master cylinder reservoirs (if necessary) with **DOT 3** brake fluid as required. It should not be necessary to bleed the system after shoe and lining removal and installation. However, if a

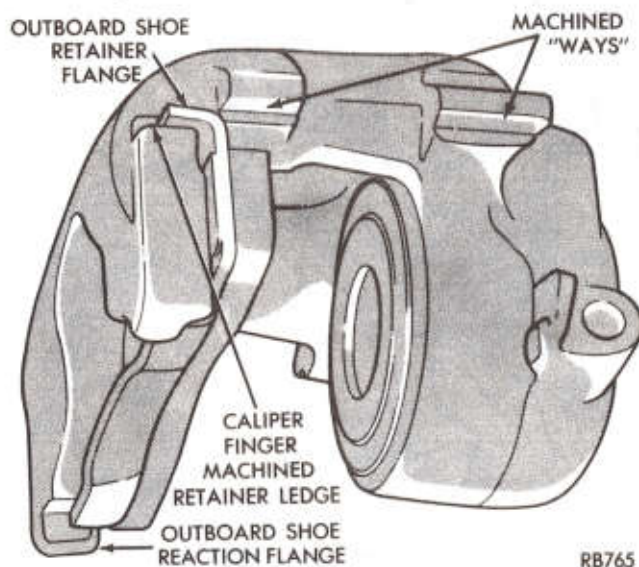


Fig. 10—Caliper and Outboard Shoe Retainer Flange

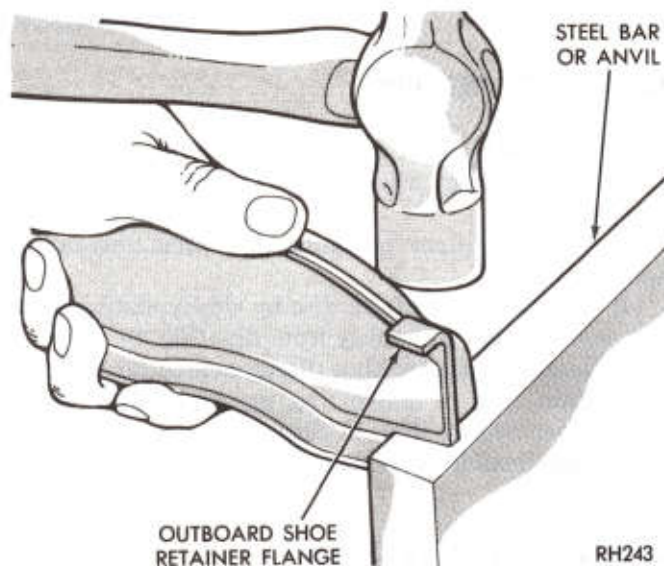


Fig. 11—Bending Outboard Shoe Retaining Flanges

firm pedal cannot be obtained bleed the brake system as described in "Bleeding the Brake System" paragraph. It may have been necessary to remove fluid to put in new linings as fluid is pushed back into the master cylinder.

(8) Install wheel and tire assemblies and wheel covers.

(9) Remove jack stands or lower hoist.

REMOVING CALIPER FROM VEHICLE

It will be necessary to remove the caliper to install a new piston seal and boot.

(1) Raise the vehicle on jackstands or hoist.

(2) Remove front wheel covers and wheel and tire assemblies.

(3) Disconnect flexible brake hose from caliper. **If pistons are to be removed from caliper leave brake**

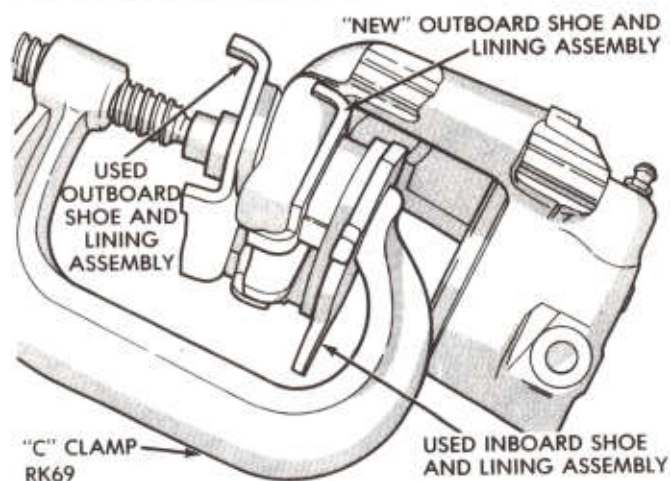


Fig. 12—Attaching Shoe to Caliper Fingers with "C" Clamp

hose connected to caliper. See "Disassembling Caliper".

Plug brake tube to prevent loss of fluid, or prop brake pedal to any position below first inch of travel. Disconnect hose from caliper.

(4) Remove retaining screw, retaining clip (and anti-rattle spring) that attach caliper to adaptor (Fig. 4). Carefully slide caliper out and away from disc and adaptor (Fig. 6).

DISASSEMBLING CALIPER

(1) Raise vehicle, remove wheel and tire assemblies.

(2) Remove retaining screw, retaining clip (and anti-rattle spring) that attach caliper to adaptor (Fig. 4). Carefully slide caliper out and away from disc and adaptor (Fig. 6). Remove outboard shoe and lining assembly from caliper, see "Brake Shoe Removal".

(3) To remove piston, support caliper assembly on upper control arms on shop towels to absorb any hydraulic fluid loss. **Carefully** depress brake pedal to hydraulically push piston out of bore (brake pedal will fall away when piston has passed bore opening) prop brake pedal to any position below the first inch of pedal travel to prevent loss of brake fluid. (If both front caliper pistons are to be removed, disconnect flexible brake line at frame bracket after removing first piston. Plug brake tube to remove piston from opposite caliper.)

CAUTION: Under no condition should air pressure be used to remove piston from bore. Personal injury could result from such practice.

(4) Disconnect brake flexible hose from the caliper.

(5) Mount caliper assembly in a vise equipped with protector jaws.

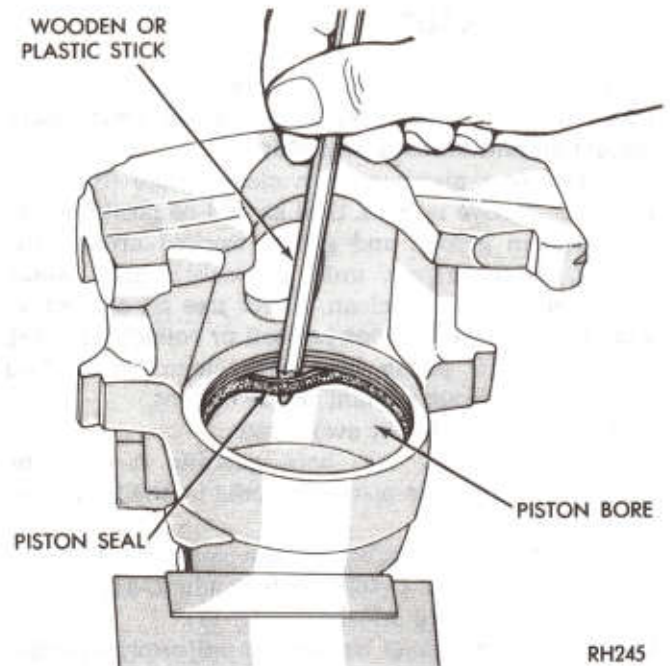
CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

(6) Remove dust boot using suitable tool.

(7) Using a small, pointed, wooden or plastic stick, work piston seal out of its groove in piston bore (Fig. 13). Discard old seal. **Do not use a screwdriver or other metal tool for this operation, because of possibility of scratching piston bore or burring edges of seal groove.**

Cleaning and Inspection

Clean all parts using alcohol or a suitable solvent and blow dry, using compressed air. Blow out all drilled passages and bores. (Whenever a caliper has been disassembled, a new boot and seal must be installed at reassembly). Inspect the piston bore for scoring or pitting. Install a new piston if it is pitted, scored or the plating is severely worn. Bores that show light scratches or corrosion, can usually be cleared with crocus cloth. However, bores that have deep scratches or scoring should be honed (Fig. 14),



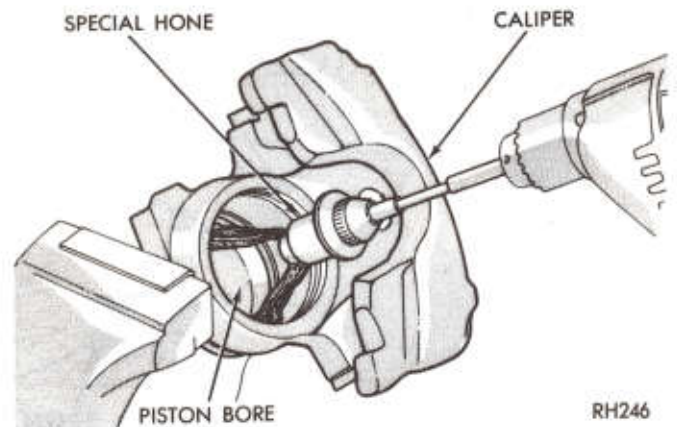
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Fig. 13—Removing Piston Seal

using Tool C-4095, providing the diameter of the bore is not increased more than .002 inch (.050mm). If the bore does not clean up within this specification, a new caliper housing should be installed. Black stains on the piston are caused by the piston seal and will do no harm.

When using Hone C-4095, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with stiff non-metallic rotary brush.

Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper with brake fluid; wipe dry with a clean, lintless cloth and then clean a second time in the same manner or until clean cloth shows no signs of discoloration.



RH246

Fig. 14—Honing Piston Bore

ASSEMBLING CALIPER

(1) Clamp caliper in vise (with protector jaws).

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

(2) Dip new piston seal in clean brake fluid and install in groove in bore. Seal should be positioned at one area in groove and gently worked around the groove, using fingers, until properly seated. Make sure that fingers are clean. **Never use an old piston seal. (Be sure seal is not twisted or rolled) (Fig. 15).**

(3) Coat new piston boot with clean brake fluid leaving a generous amount inside of boot.

(4) Position dust boot over piston.

(5) Install piston into bore pushing it past the piston seal until the piston bottoms in the bore (Fig. 16).

(6) Position the dust boot in the counterbore. Using a hammer and Tool C-4690 with handle C-4171, drive the boot onto the counterbore (Fig. 17).

CAUTION: Force must be applied uniformly to avoid cocking.

(7) Install brake hose to caliper using new seal washers.

Before installing caliper assembly on vehicle, inspect braking disc. Conditions are described in "Checking Braking Disc for Runout and Thickness" paragraph.

INSTALLING CALIPER

Examine lining for wear, damage or fluid contamination if its condition is found satisfactory it may be reused. If not usable both front brakes must be relined with new lining. If old lining is to be reused, be sure

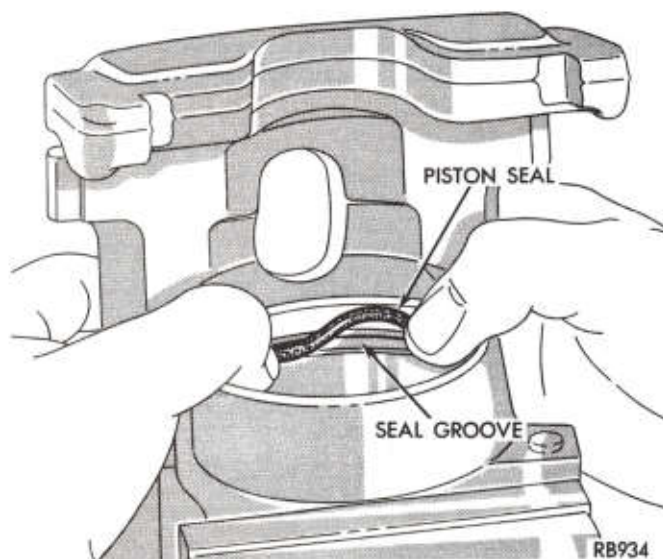


Fig. 15—Installing Piston Seal

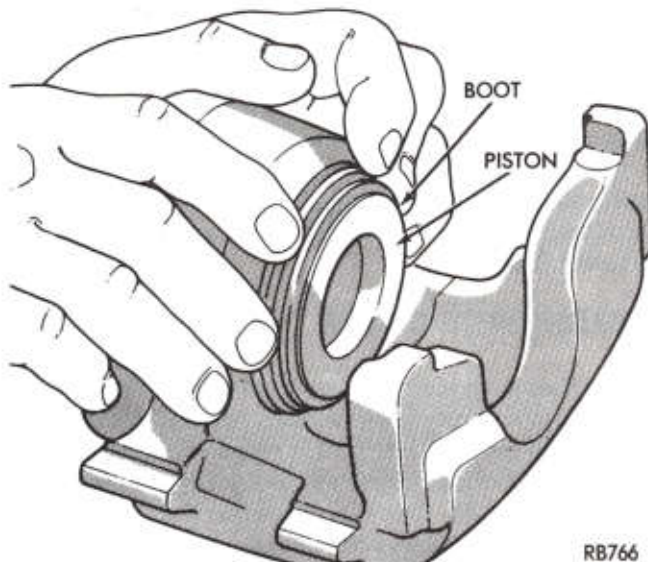


Fig. 16—Installing Piston through Boot

linings are installed in their original position.

(1) Slide new outboard shoe and lining assembly in recess of caliper.

CAUTION: No free play between brake shoe flanges and caliper fingers (Fig. 10) should exist (which might cause brake shoe rattle).

If free play is evident by vertical shoe movement after installation, remove shoe from caliper and bend flanges (Fig. 11) to create slight interference fit to eliminate all vertical free play when shoe is installed. Install shoe after above modification, if necessary, by snapping shoe into place with fingers or with light

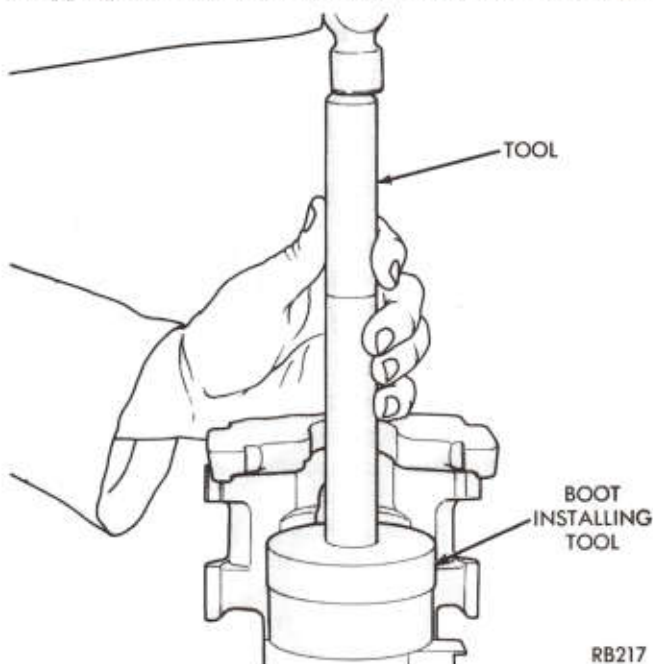


Fig. 17—Installing Piston Dust Boot

"C" clamp, protect new lining from damage or contamination by using old pads over new lining and across caliper fingers (Fig. 12).

(2) Position inboard shoe in position on adaptor with shoe "flanges" in the adapter "ways" (Fig. 8).

(3) Slowly slide caliper assembly into position in adaptor and over disc. Align caliper on machined ways of adaptor. **Be careful not to pull the dust boot from its groove as the piston and boot slide over the inboard shoe.**

(4) Install anti-rattle springs and retaining clips and torque retaining screws to 200 inch-pounds.

The inboard shoe anti-rattle spring must always be installed on top of the retainer spring plate (Fig. 4).

(5) With bleeder screw open, allow caliper to "Gravity" fill with brake fluid, then close bleeder screw. (Be sure all air bubbles have escaped; replenish brake fluid in master cylinder. Bleed brakes as described under "Bleeding Brakes" paragraph).

(6) **Pump brake pedal several times until a firm pedal has been obtained.**

(7) After bleeding caliper, check for fluid tightness under maximum pedal pressures. (Recheck master cylinder reservoir level).

(8) Install wheel and tire assembly. Tighten stud nuts as described in "Wheels, Bearings and Tires" Group 22.

(9) Remove jackstands or lower hoist.

(10) **Road test vehicle and make several stops to**

wear off any foreign material on the brakes and to seat the linings. The vehicle may pull to one side or the other if this is not done.

BLEEDING DISC BRAKE

The disc brake hydraulic system can be bled manually or with pressure bleeding equipment. Refer to "Hydraulic System Control Valves" section for lock-out during bleeding procedure. On disc brake equipped vehicles, the brake pedal will require more pumping, and frequent checking of the fluid level in the master cylinder during the bleeding operation. **Never use brake fluid that has been drained from the hydraulic system, when bleeding the brakes.**

On vehicles equipped with disc brakes, be sure that the disc brake piston is returned to a normal position and that the shoe and lining assemblies are properly seated.

Before driving the vehicle, check the operation of the brakes to be sure that a firm pedal has been obtained.

(1) Raise vehicle using a hoist or jackstands.

(2) Bleed brakes in usual manner, starting with right rear, then proceeding to left rear, right front and left front in order.

After bleeding the brakes, proceed as follows:

(1) Remove jackstands or lower hoist.

(2) Test drive vehicle to be sure brakes are operating correctly and that pedal is solid.

BRAKING DISC (ROTOR) - CHRYSLER (D150, D250, D350, AD150)

INDEX

	Page
Checking Braking Disc for Runout and Thickness	40
General Information	39
Inspection Diagnosis	39

	Page
Refinishing (Refacing) Braking Disc	40
Installing Braking Disc and Hub	40
Removing Braking Disc and Hub	40

GENERAL INFORMATION

Any servicing of the brake disc requires extreme care to maintain the brake disc within service tolerances to ensure proper brake action. This includes wheel bearing adjustment (front) after lubrication as well as any refinishing operations.

Inspection Diagnosis

Before refinishing or refacing a braking disc, the disc should be checked and inspected for the following conditions.

(1) Scoring, rust, impregnation of lining material and worn ridges.

(2) Runout or wobble.

(3) Thickness variation (Parallelism).

(4) Dishing or distortion (Flatness).

If a vehicle has not been driven for a period of time, the discs will rust in the area not covered by the lining and cause noise and chatter. Excessive wear and scoring of the disc can cause temporary improper lining contact if ridges are not removed before installation of new lining (pads).

Some discoloration or wear of the disc surface is normal and does not require re-surfacing when linings are replaced.

Excessive runout or wobble in a disc can increase pedal travel due to piston knockback and increase seal bushing wear due to necessity of caliper to follow disc wobble.

Thickness variation in a disc can also result in pedal pulsation, chatter and surge due to variation in brake output when disc section is uneven. Dishing or

distortion can be caused by extreme heat and abuse of the brakes.

SERVICE PROCEDURES

CHECKING BRAKING DISC FOR RUNOUT AND THICKNESS

(1) Mount dial indicator C-3339 on steering arm with plunger contacting disc approximately one (1) inch (25.4mm) from the edge of the disc (Fig. 1).

(2) With wheel bearings adjusted to zero end play, check lateral runout (both sides of disc). Runout should not exceed specifications in the following chart.

	D150, AD150	D250, D350
Runout	.004 Inch (.101 mm)	.005 Inch (.127 mm)
Thickness Variation	.0005 Inch (.0127 mm)	.001 Inch (.025 mm)

If runout is in excess of specification, install a new disc and hub assembly or reface disc, being careful to remove as little as possible from each side of disc. Remove equal amounts from each side of disc. Do not reduce thickness below minimum thickness shown in refinishing section of this Group. Be sure and readjust wheel bearings after check.

(3) Thickness variation measurements of disc should be made in conjunction with runout. Measure thickness of disc at twelve (12) equal points with a micrometer at a radius approximately one (1) inch from edge of disc. If thickness measurements exceed

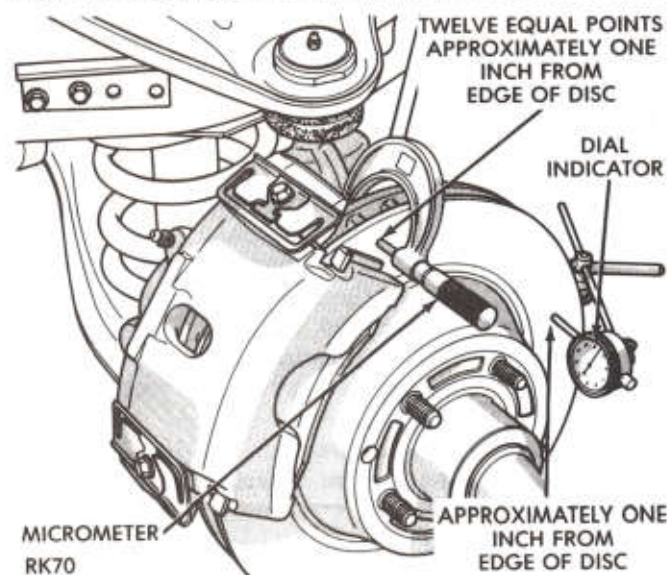


Fig. 1—Checking Brake Disc for Runout and Thickness

specifications, disc should be removed and resurfaced or a new disc and hub assembly installed (Fig. 1).

(4) Light scoring and/or wear is acceptable. If heavy scoring or warping is evident, the disc must be refinished or replaced (see Refinishing (Refacing) Braking Disc). If cracks are evident the disc and hub assembly must be replaced.

REMOVING BRAKING DISC AND HUB

(1) Raise and support vehicle on hoist or jackstands. Remove wheel cover and wheel and tire assembly.

(2) Remove caliper assembly as described under "Removing Caliper" this Group, but do not disconnect brake line. Suspend caliper from wire hook to avoid strain on flexible hose.

(3) Remove grease cap, cotter pin, nut lock, nut thrust washer and outer wheel bearing.

(4) Pull disc and hub off wheel spindle.

INSTALLING BRAKING DISC AND HUB

(1) Slide brake disc and hub assembly on spindle.

(2) Install outer bearing, thrust washer and nut.

(3) Tighten wheel bearing adjusting nut to 90 inch-pounds while rotating disc and hub. Recheck disc runout as described previously.

(4) Back off adjusting nut to release all preload, then retighten adjusting nut finger tight.

(5) Position lock nut on nut with one pair of slots in line with cotter pin hole. Install and lock cotter pin.

(6) Clean grease cap and coat inside with wheel bearing grease (do not fill cap) and install cap. Clean both sides of disc with alcohol or suitable solvent.

(7) Install caliper assembly, as described in "Installing Caliper" paragraph.

REFINISHING (REFACING) BRAKING DISC

Resurfacing Braking Disc

This operation can be used when the disc surface is rusty or has lining deposits. A sanding disc attachment will remove surface contamination without removing much material. It will generally follow variations in thickness which are in the disc.

Refacing Braking Disc

Rotors do not have to be refaced every time a disc brake is relined. If the rotor surface is deeply scored or warped or there is a complaint of brake roughness the rotor should be refaced (Fig. 2).

When refacing a disc brake rotor the required TIR (Total Indicator Reading) and thickness variation **MUST BE MAINTAINED**. **Extreme care** in the operation of rotor turning equipment is required. The collets, shafts and adaptors on the lathe and the bearing cups in the rotor **MUST** be clean and free from any chips or contamination. When mounting the disc on the lathe strict attention to the manufacturer's instructions is required. If the disc is not mounted properly the runout will be worse after refacing than before refacing.

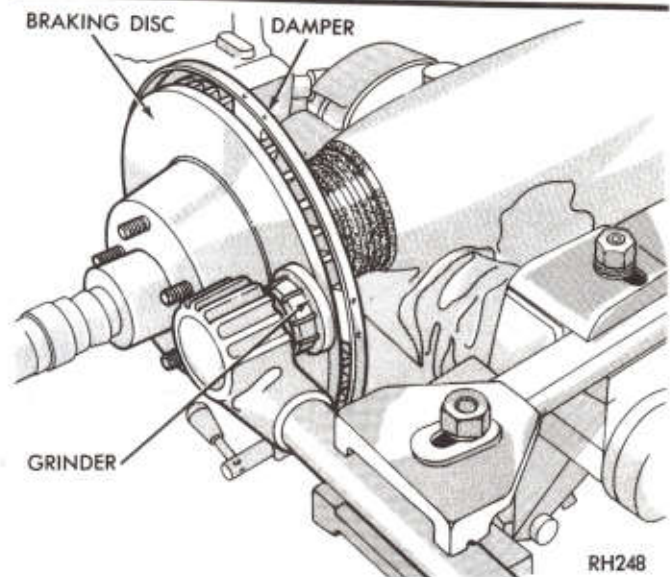
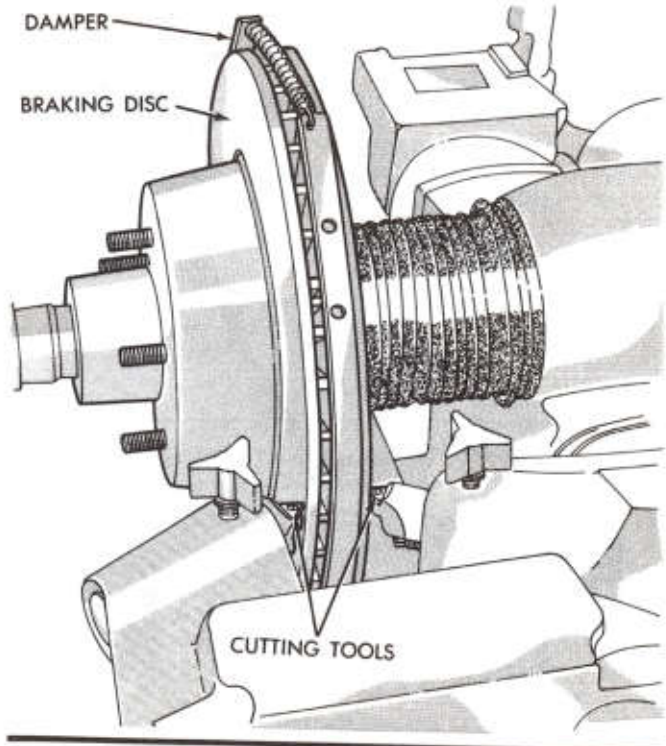
The use of a double straddle cutter which machines both sides of the disc at the same time is **mandatory**.

Do not reface a disc brake rotor more than .030 inch less than the original disc minimum thickness. Reface both sides of rotor, not exceeding .030 total. Figure 3 shows the location of measurement and specifications when servicing the braking disc.

All rotors (disc) will show marking of minimum allowable thickness cast on the un-machined surface. This marking includes .030 inch (.762mm) allowable rotor wear beyond the recommended .030 inch (.762mm) of disc refacing.

Example:

Minimum Allowable Thickness	.940 (23.8mm)
Allow for Wear	.030 (.762mm)
Do Not Reface Beyond	.970 (24.6mm)



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Fig. 2—Refacing Braking Disc

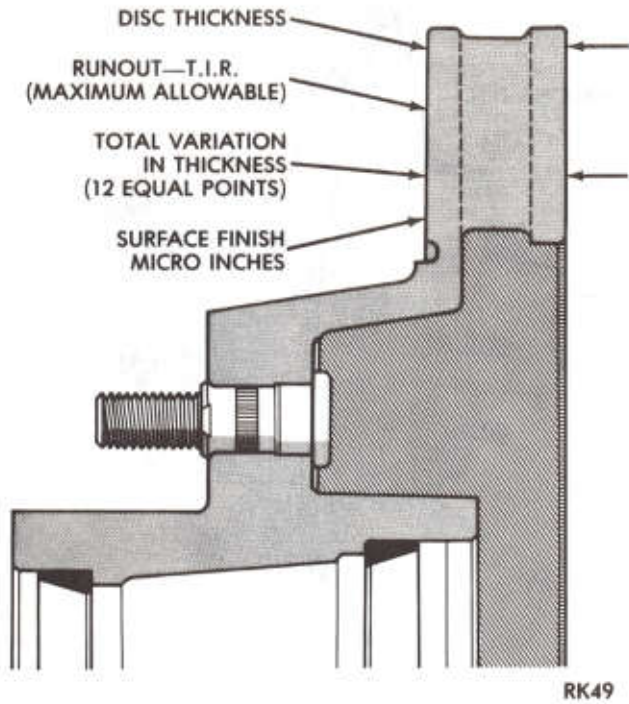


Fig. 3—Disc Specification Points

REFINISHING LIMITS

Model	Thickness	Thickness Variation	Runout	Micro Finish
D150, AD150	1.240/1.250 (31.49/31.75mm)	.0005 (.0127mm)	.004 (.101mm)	15-80 (.381-.457)
D250	1.240/1.250 (31.49/31.75mm)	.001 (.025mm)	.005 (.127mm)	15-80 (.381-.457)
D250 D350	1.170/1.190 (29.71/30.22mm)	.001 (.025mm)	.005 (.127mm)	15-80 (.381-.457)

**DISC BRAKE—CHRYSLER
(W150, W250, AW150)**

INDEX

	Page		Page
Assembling Caliper	48	General Information	42
Brake Roughness	45	Hold-Off Valves	43
Brake Shoe Installation	46	Installing Caliper	48
Brake Shoe Removal	45	Removing Caliper from Vehicle	46
Cleaning and Inspection	45,47	Routine Maintenance	43
Disassembling Caliper	47	Service Diagnosis	7
Disc Brake Service Precautions	45	Specifications	61

GENERAL INFORMATION

The single piston sliding caliper disc brake assembly (Fig. 1), consists of the one piece hub and disc assembly, the caliper, shoes and linings, splash shield and adaptor.

The cast iron braking disc has cooling fins or louvres that are cast integrally between the two

machined braking surfaces (Fig. 2).

When the wheel is in motion, the rotation of the disc cooling fins supplies air circulation between the braking surfaces for efficient cooling of the disc and prolonged lining life. The braking disc is protected from road splash (inboard side) by a shield bolted to

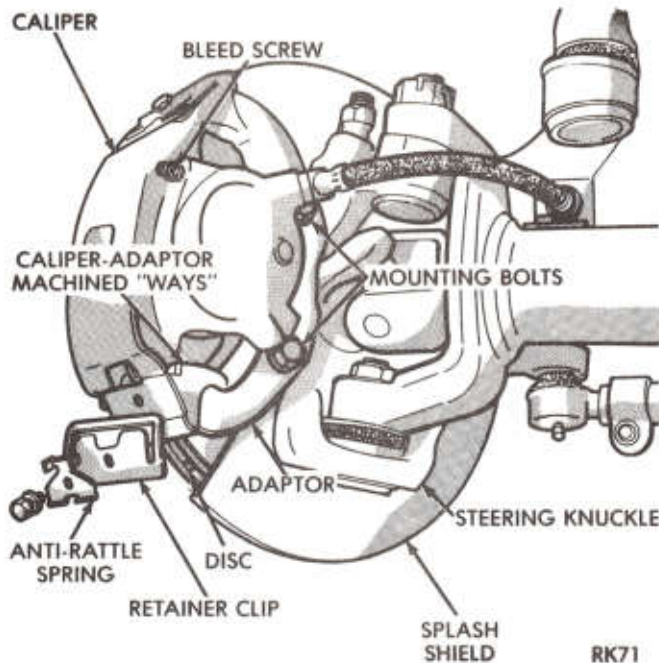


Fig. 1—Disc Brake Assembly (Rear View)

the steering knuckle and by the wheel and tire on the outboard side (Fig. 3).

Two machined abutments on the adaptor position and align the caliper. The retaining clips retain the caliper in the machined guides or "ways" on the adaptor and allow lateral movement of the caliper (Fig. 1).

Flanges on the outboard shoe (Fig. 5) are used to radially locate and position the shoe on the caliper fingers. The inboard shoe is held in a captive position by the adaptor (Fig. 6). All braking force on the outboard shoe is taken by the caliper. The inboard shoe reacts directly on the adaptor.

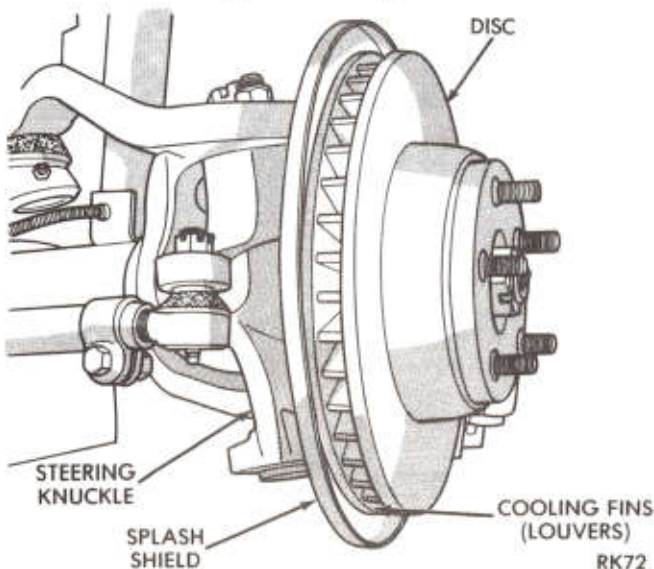


Fig. 2—Brake Assembly (Front View)

The caliper is a one piece casting with the inboard side containing the single piston cylinder bore. A phenolic piston is used. The square cut rubber piston seal is located in a machined groove in the cylinder bore and provides a hydraulic seal between the piston and the cylinder wall (Fig. 3). The adaptor is mounted on the steering knuckle by two special nylock bolts (Fig. 1).

A moulded rubber dust boot installed in a groove in the cylinder bore and piston keeps contamination from the cylinder wall and piston. The boot has a wiping lip that prevents contamination in the bore area.

As the brake pedal is depressed, hydraulic pressure is applied against the piston. This force is transmitted to the inboard brake shoe and lining and the inboard braking surface of the disc. As force increases against the disc from the inner lining, the caliper assembly moves inboard, sliding on the machined adaptor "ways", thus providing a clamping force on the disc.

When the brake pressure is released, the piston seal (distorted by applied pressure) returns to its normal position, pulling the piston back to released position (Fig. 4), creating a slight running clearance between outer shoe and the disc.

Automatic adjustment is obtained by outward relocation of the piston as the inboard lining wears and the inward movement of the caliper as the outboard lining wears, thus maintaining correct adjustment at all times.

HOLD-OFF VALVES

Hold-off valves are used because of different braking characteristics between disc and drum brakes.

With disc brakes, brake application is immediate and braking response is directly proportional to pedal effort. Drum brake response occurs after piston travel, return spring stretch and shoe contact with the drum, then self energizing tends to multiply pedal effort.

Hold-off valves are used to momentarily hold off front (disc brake) hydraulic system pressure until rear drum brakes begin to apply.

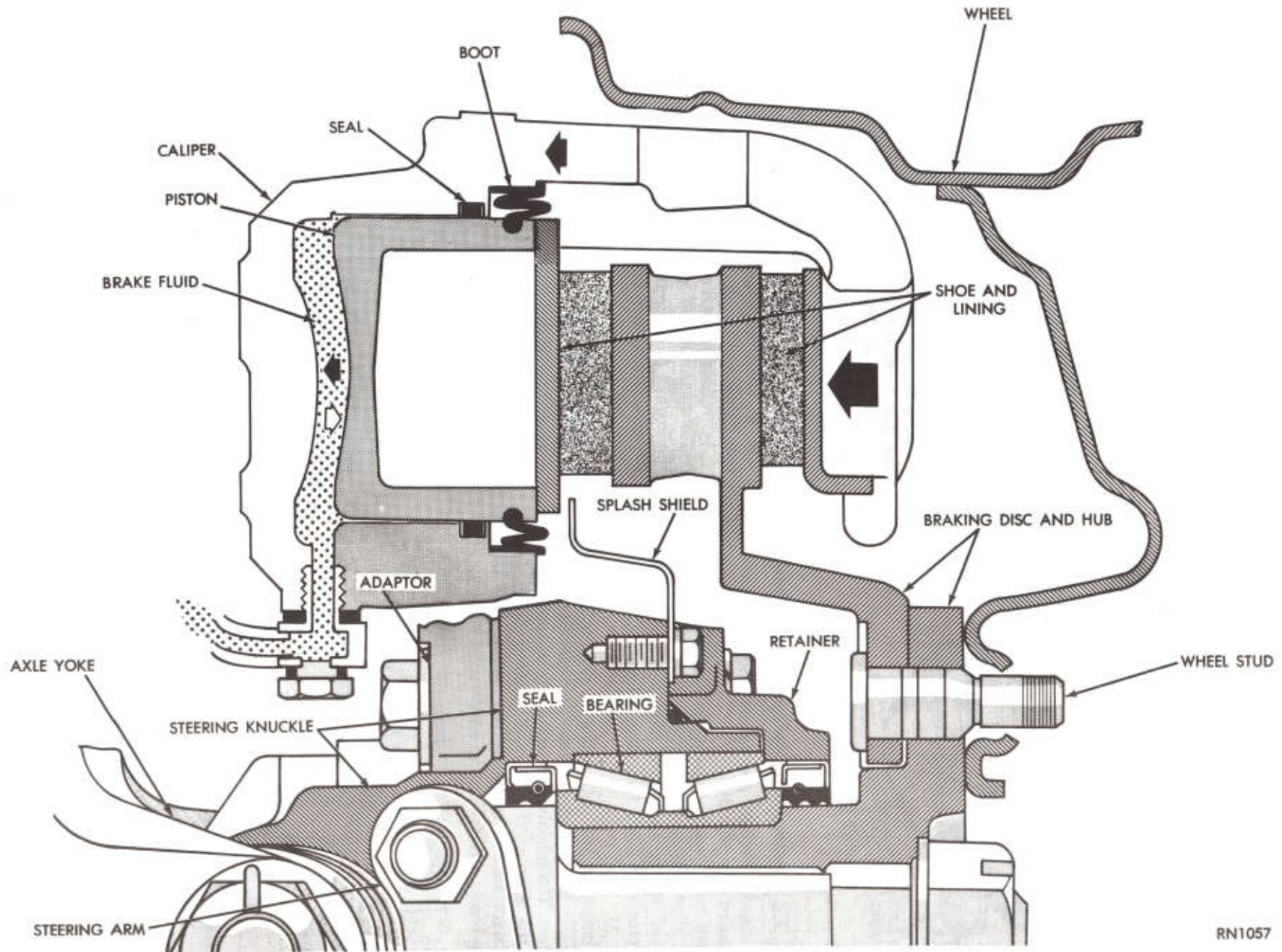
For valve application and service, see "Hydraulic System Control Valves", this group.

ROUTINE MAINTENANCE

Check Brake Lines, Hoses and Linings

Raise all four wheels. Remove front wheel and tire assemblies and inspect the braking disc, linings and caliper. Inspect brake flexible hose and tubing according to procedure outlined in "Brake Hose and Tubing."

Do not get oil or grease on the braking disc or linings. If the linings (pads) are worn to within .030 inch (.76mm) of the shoe, or rivets, replace both sets of



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Fig. 3—Disc Brake Assembly

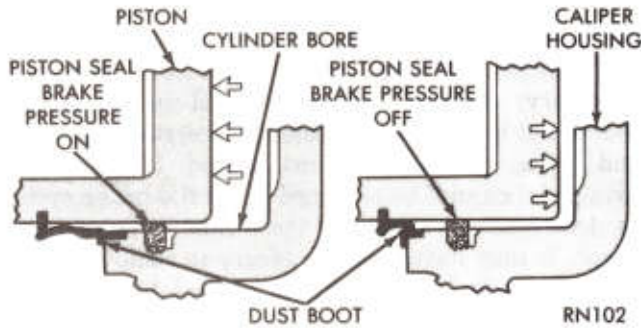


Fig. 4—Piston Seal Function for Automatic Adjustment

shoe and lining assemblies, (inboard and outboard) on the front wheels. It is necessary that both front wheel sets be replaced whenever a respective shoe and lining is worn beyond specifications or damaged.

Check all brake tube connections for possible leaks. Install new flexible hoses as required.

Check adapter plate to knuckle bolts for specified torque.

Brake Roughness

The most common cause of brake roughness (or chatter) with disc brakes is excessive variation in disc thickness. This can be easily checked with a 2 in. micrometer (vernier type preferred). If this measurement is out of specification, the disc must be refinished or replaced. Refer to "Brake Disc", this Group.

Other less prevalent causes of roughness can be the use of some types of non-standard lining and extreme abrasion of the disc faces. Also, vehicles which stand unused for periods of time in areas of high humidity or salt air may incur rust on the disc which could cause a temporary brake surge and roughness. Normally however, this condition should correct itself after a short period of usage. If rust is severe enough roughness will not clear up and the disc must be

refinished or replaced.

DISC BRAKE SERVICE PRECAUTIONS

(1) Grease or any other foreign material must be kept off the caliper assembly, surfaces of the braking disc and external surfaces of the hub, during service procedures. Handling the braking disc and caliper should be done in such a way as to avoid deformation of the disc and scratching or nicking the brake linings (pads).

(2) If inspection reveals that the square sectioned caliper piston seal is worn or damaged, it should be replaced immediately.

(3) During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

(4) The front wheel bearing end play is important and must be within specifications.

(5) Be sure vehicle is centered on the hoist before servicing any of the front end components to avoid bending or damaging disc splash shield on full right or left hand turns.

(6) Before vehicle is moved after any brake service work, **be sure and obtain a firm brake pedal** by using proper bleeding procedures: see "Hydraulic System Control Valves", this Group.

(7) Dragging the brakes (common result of left foot application) should be avoided during vehicle operation.

(8) The wheel, tire, hub and disc assembly **cannot** be removed as an assembly. The caliper assembly must be removed before removal of the hub and disc assembly.

(9) As lining wears, reservoir level will go down. If fluid has been added between relines, then reservoir overflow may occur when the piston is pushed back into the new lining position. Overflowing can be avoided in this case by removal of a small amount of fluid before overflow occurs.

SERVICE PROCEDURES

BRAKE SHOE REMOVAL

- (1) Raise vehicle on a hoist or jackstands.
- (2) Remove front wheel covers, and wheel and tire assemblies.
- (3) Remove caliper retaining clips and anti-rattle springs (Fig. 1).
- (4) Remove caliper from disc by slowly sliding caliper assembly out and away from disc (Fig. 5).
- (5) Remove outboard shoe (flanges on outboard shoe and retain shoe to caliper) by prying between shoe and caliper fingers (Fig. 6). Support caliper so as not to damage flexible brake hose. Remove inboard brake shoe (Fig. 7).

CLEANING AND INSPECTION

Check for piston seal leaks (evident by brake fluid in and around boot area and inboard lining) and for any ruptures of piston dust boot. If boot is damaged, or fluid is evident, it will be necessary to disassemble caliper assembly and install a new seal, boot, (and piston if damaged or corroded.) (Refer to "Disassembling Caliper Assembly" paragraph). Check the mating surface of the abutments on the caliper and adaptor. If corroded or rusty, clean surfaces with wire brush. Inspect braking surfaces of disc.

BRAKE SHOE INSTALLATION

(1) Slowly and carefully push piston back into bore until it is bottomed. Watch for possible reservoir overflow. See step 9 of "Disc Brake Service Precautions."

(2) Slide new outboard shoe and lining assembly in recess of caliper after removing paper from noise suppression gasket.

CAUTION: No free play between brake shoe flanges and caliper fingers (Fig. 9) should exist (which might cause brake shoe rattle).

If free play is evident by vertical shoe movement after installation, remove shoe from caliper and bend flanges (Fig. 10) to create slight interference fit to eliminate all vertical free play when shoe is installed. Install shoe after above modification if necessary, by snapping shoe into place with fingers or with light "C" clamp, protect new lining from damage or contamination by using old pads over new lining and across caliper fingers (Fig. 11).

(3) Remove paper from noise suppression gasket and then position inboard shoe in position on adaptor with shoe "flanges" in the adaptor "ways" (Fig. 7).

(4) Slowly slide caliper assembly into position in adaptor and over disc. Align caliper on machined ways of adaptor. **Be careful not to pull the dust boot from its groove as the piston and boot slide over the inboard shoe.**

(5) Install anti-rattle springs and retaining clips and torque retaining screws to 200 inch-pounds.

The inboard shoe anti-rattle spring must always be installed on top of the retainer spring plate (Fig. 1).

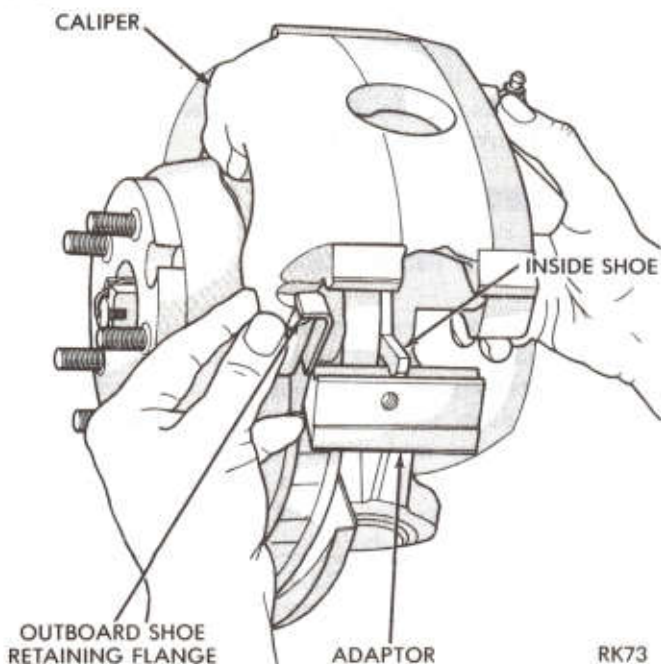


Fig. 5—Removing or Installing Caliper

(6) Pump brake pedal several times until a firm pedal has been obtained.

(7) Check and refill master cylinder reservoirs (if necessary) with **DOT 3** brake fluid as required. It should not be necessary to bleed the system after shoe and lining removal and installation. However, if a firm pedal cannot be obtained bleed the brake system as described in "Bleeding the Brake System" paragraph. It may have been necessary to remove fluid to put in new linings as fluid is pushed back into the master cylinder.

(8) Install wheel and tire assemblies and wheel covers.

(9) Remove jack stands or lower hoist.

REMOVING CALIPER FROM VEHICLE

It will be necessary to remove the caliper to install a new piston seal and boot.

(1) Raise the vehicle on jackstands or hoist.

(2) Remove front wheel covers and wheel and tire assemblies.

(3) Disconnect flexible brake hose from caliper. **If pistons are to be removed from caliper leave brake hose connected to caliper. See "Disassembling Caliper".**

Plug brake tube to prevent loss of fluid, or prop brake pedal to any position below first inch of travel. Disconnect hose from caliper.

(4) Remove retaining screw, retaining clip (and anti-rattle spring) that attach caliper to adaptor (Fig. 1). Carefully slide caliper out and away from disc and adaptor (Fig. 5).

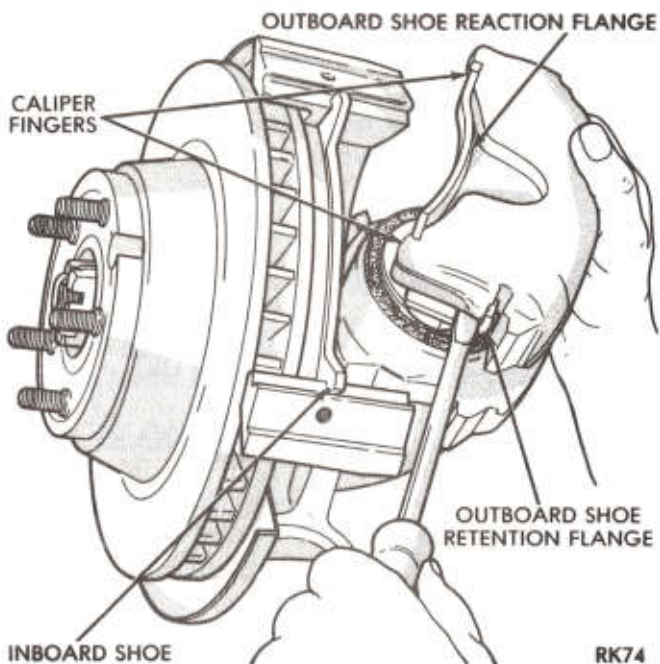


Fig. 6—Removing Outboard Shoe

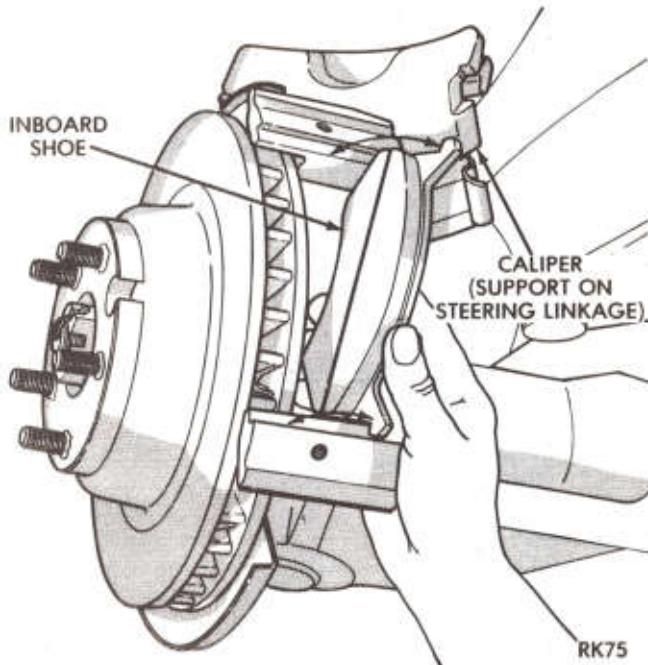


Fig. 7—Removing or Installing Inboard Shoe

DISASSEMBLING CALIPER

After removing caliper assembly from adaptor (with brake hose attached) as described above, complete disassembly as follows.

(1) To remove piston, support caliper assembly on steering knuckle on shop towels to absorb any hydraulic fluid loss. **Carefully** depress brake pedal to hydraulically push piston out of bore (brake pedal will fall away when piston has passed bore opening) prop brake pedal to any position below the first inch of pedal travel to prevent loss of brake fluid. (If both front caliper pistons are to be removed, disconnect flexible brake line at frame bracket after removing first piston. Plug brake tube to remove piston from opposite caliper.)

CAUTION: Under no condition should air pressure be used to remove piston from bore. Personal injury

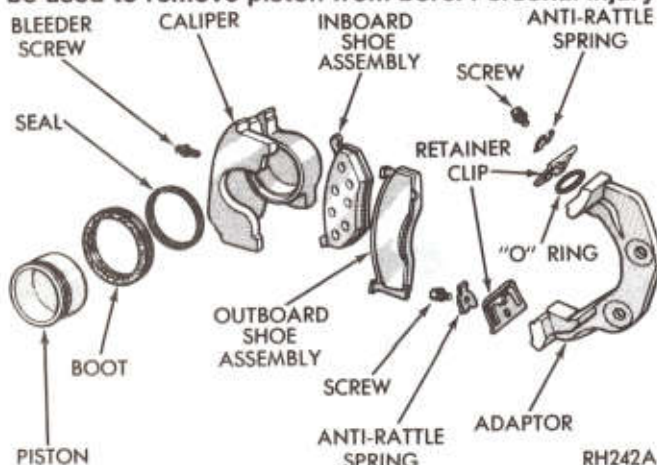


Fig. 8—Caliper Assembly

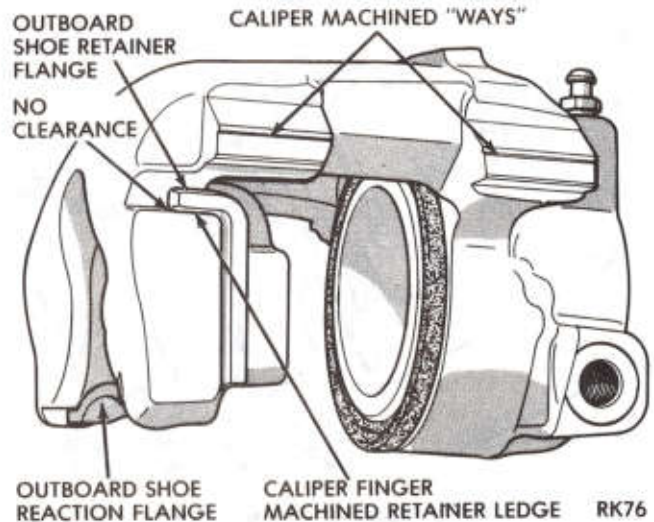


Fig. 9—Caliper Finger and Outboard Shoe Retainer Flange

could result from such practice.

(2) Disconnect brake flexible hose from the caliper.

(3) Mount caliper assembly in a vise equipped with protector jaws.

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

(4) Remove dust boot using suitable tool.

(5) Using a small, pointed, wooden or plastic rod, work piston seal out of its groove in piston bore (Fig. 12). Discard old seal. **Do not use a screwdriver or other metal tool for this operation, because of possibility of scratching piston bore or burring edges of seal groove.**

CLEANING AND INSPECTION

Clean all parts using alcohol or a suitable solvent

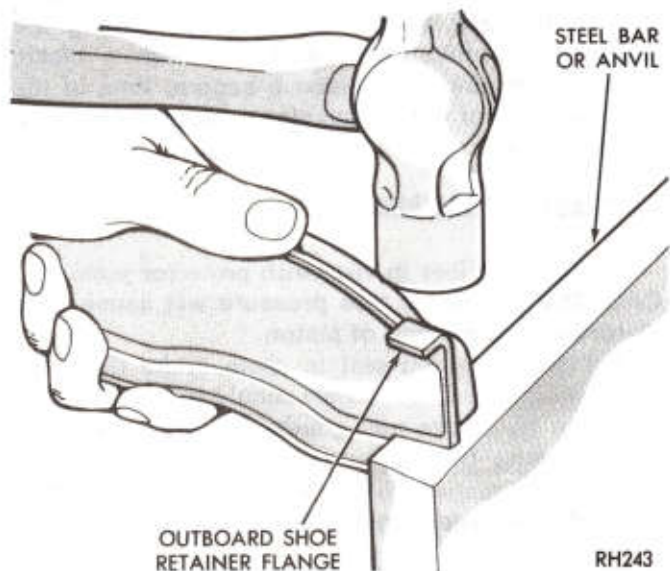


Fig. 10—Bending Outboard Shoe Retaining Flange

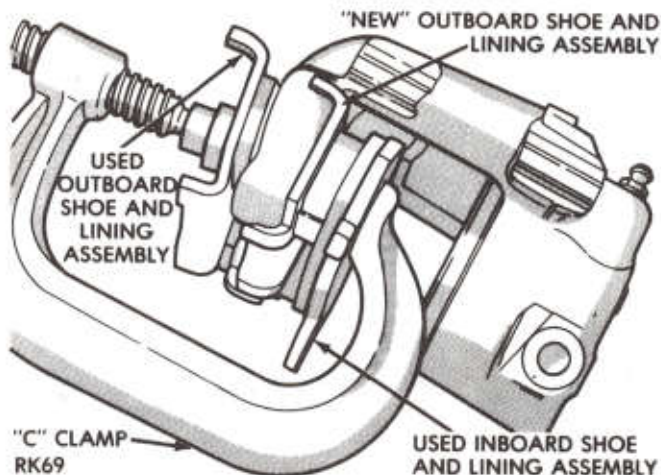


Fig. 11—Attaching Shoe to Caliper Fingers with "C" Clamp

and blow dry, using compressed air. Blow out all drilled passages and bores. (Whenever a caliper has been disassembled, a new boot and seal must be installed at reassembly). Inspect the piston bore for scoring or pitting. Install a new piston if it is pitted, scored or the plating is severely worn. Bores that show light scratches or corrosion, can usually be cleared with crocus cloth. However, bores that have deep scratches or scoring should be honed (Fig. 13), using Tool C-4095, providing the diameter of the bore is not increased more than .002 inch. If the bore does not clean up within this specification, a new caliper housing should be installed. Black stains on the piston are caused by the piston seal and will do no harm. **When using Hone C-4095, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with stiff non-metallic rotary brush.**

Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper with brake fluid; wipe dry with a clean, lintless cloth and then clean a second time in the same manner or until clean cloth shows no signs of discoloration.

ASSEMBLING CALIPER

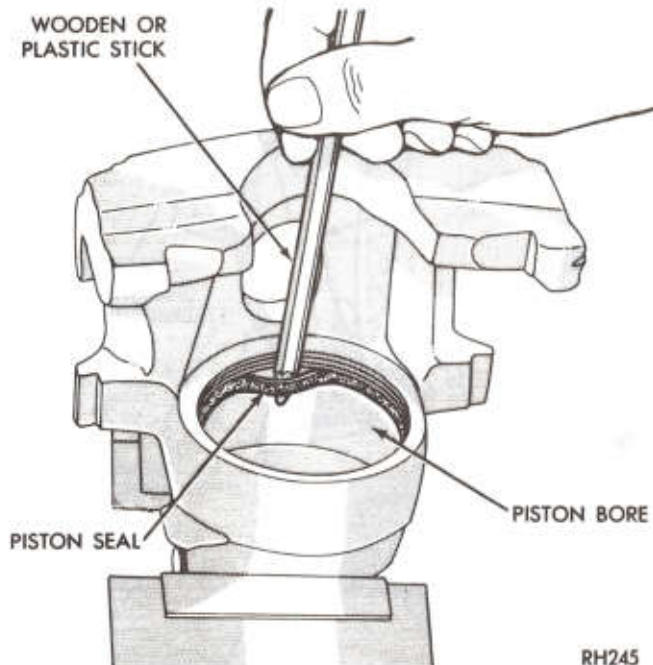
- (1) Clamp caliper in vise (with protector jaws).

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

- (2) Dip new piston seal in clean brake fluid and install in groove in bore. Seal should be positioned at one area in groove and gently worked around the groove, using fingers, until properly seated. Make sure that fingers are clean. **Never use an old piston seal. (Be sure seal is not twisted or rolled) (Fig. 14).**

- (3) Coat new piston boot with clean brake fluid leaving a generous amount inside of boot.

- (4) Position dust boot over piston.



RH245

Fig. 12—Removing Piston Seal

- (5) Install piston into bore pushing it past the piston seal until the piston bottoms in the bore (Fig. 15).

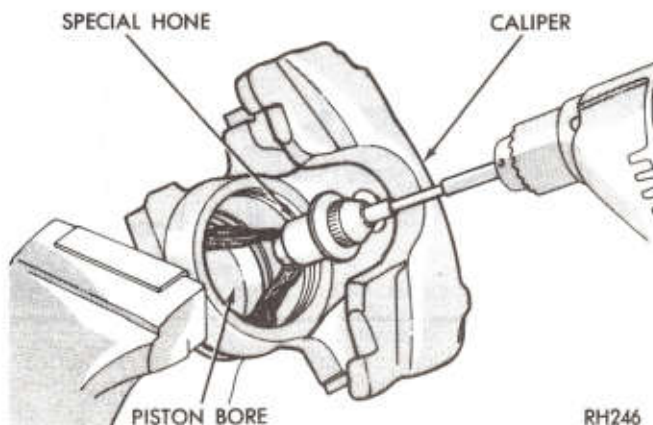
- (6) Position the dust boot in the counterbore. Using a hammer and Tool C-4690 with handle C-4171, drive the boot onto the counterbore (Fig. 16).

CAUTION: Force must be applied uniformly to avoid cocking.

Before installing caliper assembly on vehicle, inspect braking disc. Conditions described in "Checking Braking Disc for Runout and Thickness" paragraph.

INSTALLING CALIPER

Examine lining for wear, damage or fluid contamination if its condition is found satisfactory it may be reused. If not usable both front brakes must be relined with new lining. If old lining is to be reused, be sure



RH246

Fig. 13—Honing Piston Bore

linings are installed in their original position.

(1) Slide new outboard shoe and lining assembly in recess of caliper.

CAUTION: No free play between brake shoe flanges and caliper fingers (Fig. 9) should exist (which might cause brake shoe rattle). If free play is evident by vertical shoe movement after installation, remove shoe from caliper and bend flanges (Fig. 10) to create slight interference fit to eliminate all vertical free play when shoe is installed.

Install shoe after above modification, if necessary, by snapping shoe into place with fingers or with light "C" clamp, protect new lining from damage or contamination by using old pads over new lining and across caliper fingers (Fig. 11).

(2) Position inboard shoe in position on adaptor with shoe "flanges" in the adapter "ways" (Fig. 7).

(3) Slowly slide caliper assembly into position in adaptor and over disc. Align caliper on machined ways of adaptor. **Be careful not to pull the dust boot from its groove as the piston and boot slide over the inboard shoe.**

(4) Install anti-rattle springs and retaining clips and torque retaining screws to 200 in. lbs. (22.6 N-m).

The inboard shoe anti-rattle spring must always be installed on top of the retainer spring plate (Fig. 1).

(5) With bleeder screw open, allow caliper to "Gravity" fill with brake fluid, then close bleeder screw. (Be sure all air bubbles have escaped; replenish brake fluid in master cylinder. Bleed brakes as described under "Bleeding Brake System.")

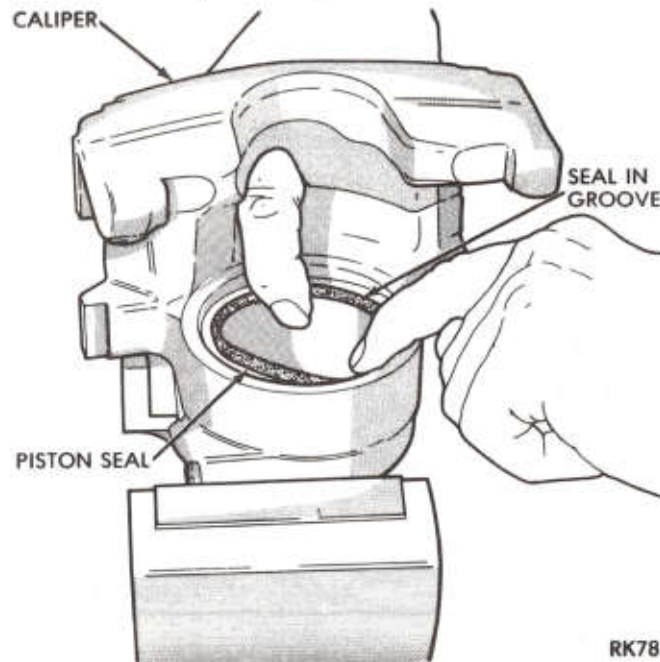


Fig. 14—Installing Piston Seal

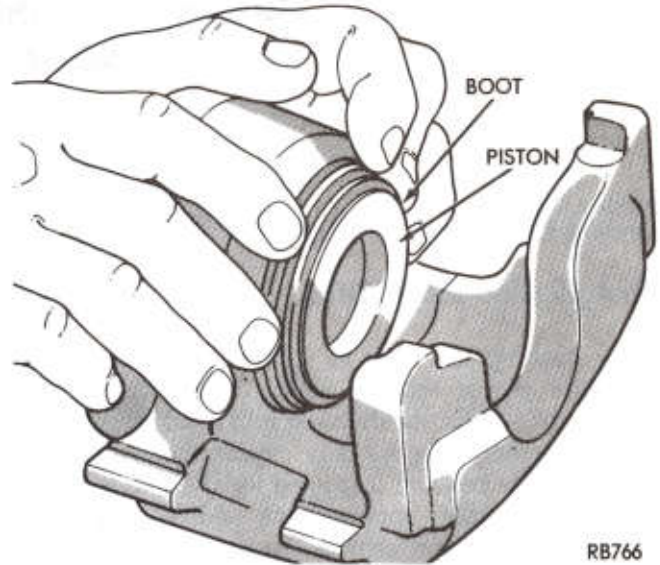


Fig. 15—Installing Piston through Boot

(6) Pump brake pedal several times until a firm pedal has been obtained.

(7) After bleeding caliper, check for fluid tightness under maximum pedal pressures. (Recheck master cylinder reservoir level).

(8) Install wheel and tire assembly. Tighten stud nuts as described in "Wheel Stud Nut Tightening".

(9) Remove jackstands or lower hoist.

(10) **Road test vehicle and make several stops to wear off any foreign material on the brakes and to seat the linings. The vehicle may pull to one side or the other if this is not done.**

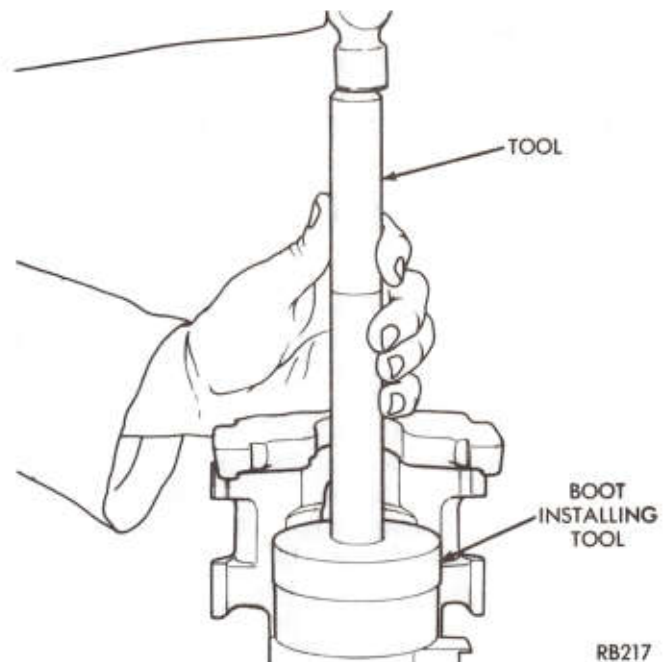


Fig. 16—Installing Piston Boot

BRAKING DISC (ROTOR) - CHRYSLER (W150, W250, AW150)

INDEX

Braking Disc Inspection	Page 50
Checking Braking Disc for Runout and Thickness	50

Removing and Installing Braking Disc	Page 51
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BRAKING DISC INSPECTION

The braking disc must be within service tolerances to ensure proper braking action. If the disc is not suitable for service the disc and hub must be replaced as an assembly. Before any replacement the disc should be checked and inspected for the following.

(1) Scoring, rust, impregnation of lining material and worn ridges: If a vehicle has not been driven for a period of time the disc will rust in the area not covered by the lining and cause noise and chatter. Excessive wear and scoring of the disc can cause temporary improper lining contact if ridges are not removed before installation of new lining (pads).

Some discoloration or wear of the disc surface is normal and does not require disc replacement when linings are replaced.

(2) Runout or wobble: Excessive runout or wobble in a disc can increase seal bushing wear due to piston knock-back and increase seal bushing wear due to necessity of caliper to follow disc wobble.

(3) Thickness Variation (Parallelism): Thickness in a disc can also result in pedal pulsation, chatter and surge due to variation in brake output when disc section is uneven.

(4) Dishing or Distortion (Flatness): This condition can be caused by extreme heat and abuse of the brakes and will create conditions similar to runout or wobble.

CHECKING BRAKING DISC FOR RUNOUT AND THICKNESS

(1) Mount dial indicator C-3339 on steering arm with plunger contacting disc approximately one inch (25.4mm) from edge of disc (Fig. 1).

(2) With wheel bearing adjusted to zero end play, check lateral runout (both sides of disc). Runout should not exceed .005 inch (.127mm).

(3) Thickness variation measurements of disc should be made in conjunction with runout. Measure thickness of disc at twelve (12) equal points with a micrometer at a radius approximately one (1) inch from edge of disc (Fig. 2). Thickness measurements should not vary more than .001 inch (.125mm).

(4) Light scoring and/or wear is acceptable. If heavy scoring or warping is evident the disc should be

replaced. If cracks are evident the disc must be replaced.

Do not reface a disc brake rotor more than .030 inch (.762mm) less than the original disc minimum thickness. Reface both sides of rotor, not exceeding .030 (.762mm) total. Figure 2 shows the location of measurement and specifications when servicing the braking disc.

All rotors (disc) will show marking of minimum allowable thickness cast on the unmachined surface. This marking includes .030 inch (.762mm) allowable rotor wear beyond the recommended .030 inch (.762mm) of disc refacing.

Example:

Minimum Allowable Thickness	.940 (23.8mm)
Allow for Wear	.030 (.762mm)
Do Not Reface Beyond	.970 (24.6mm)

REFINISHING LIMITS

Model	Thickness	Thickness Variation	Runout	Micro Finish
W150, AW150	1.240/1.250 (31.49/31.75mm)	.001 (.025mm)	.005 (.127mm)	15-80 (.381-.457)
W250	1.170/1.190 (29.71/30.22mm)	.001 (.025mm)	.005 (.127mm)	15-80 (.381-.457)

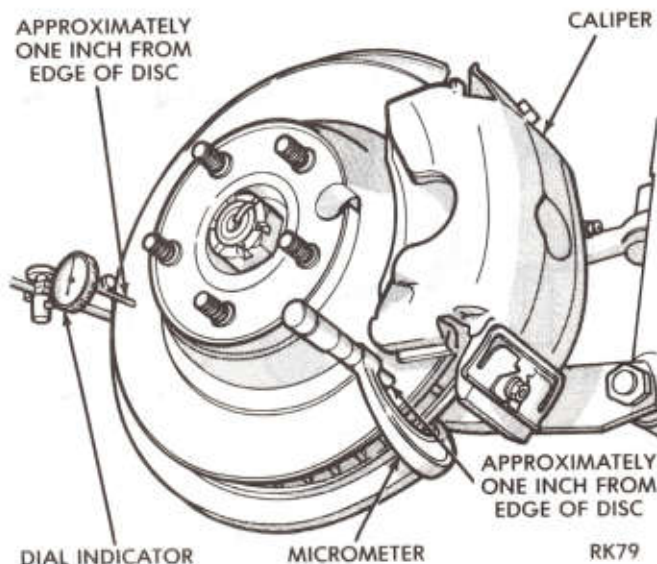
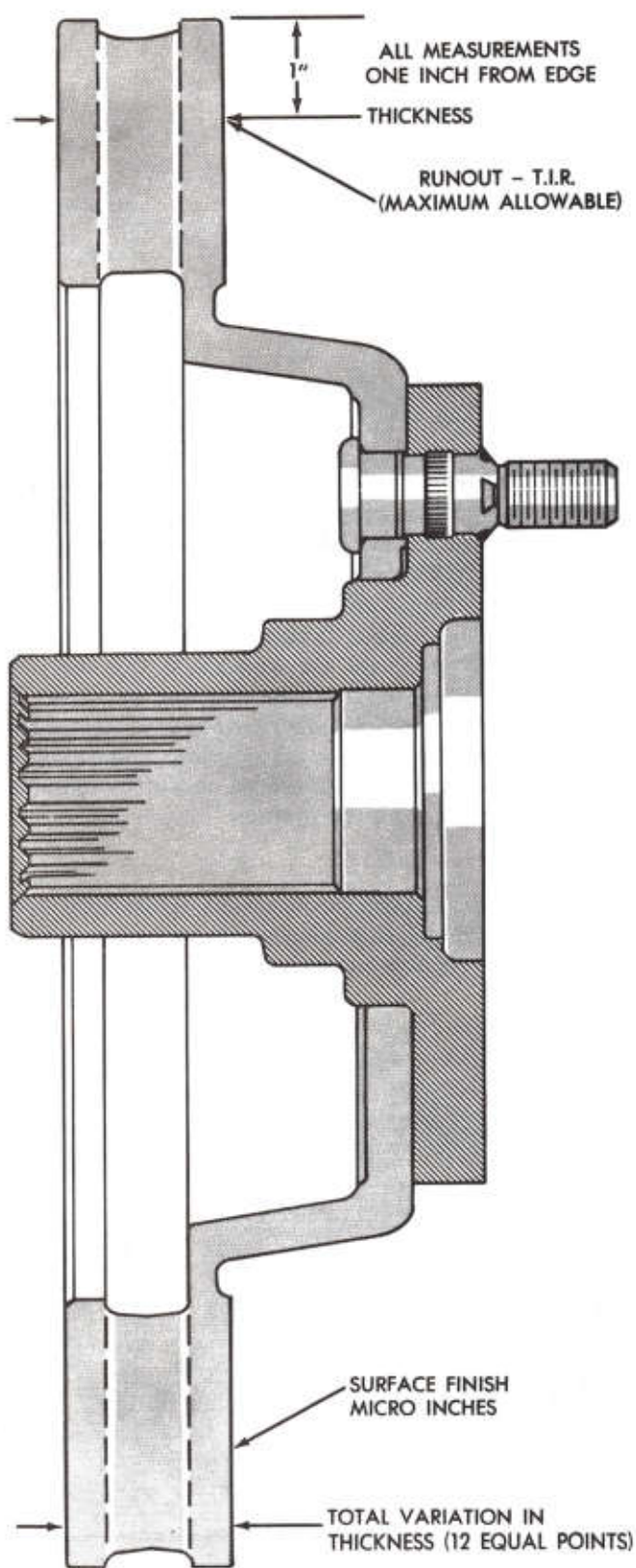


Fig. 1—Checking Brake Disc for Runout and Thickness

REMOVING AND INSTALLING BRAKING DISC

See "Braking Disc (Rotor) Hub or Bearings" in Group 2, for any service procedures that require removal and installation of braking disc (rotor).



RN1058

Fig. 2—Disc Specification Points

DISC BRAKE—BENDIX (W250, and W350)

INDEX

	Page		Page
Brake Shoe Caliper Inspection	54	Disc Brake Service Precautions	54
Brake Shoe Installation	55	General Information	52
Brake Shoe Removal	54	Hold-Off Valves	53
Caliper Overhaul	56	Routine Maintenance	53
Cleaning and Inspection	55	Specifications	61

GENERAL INFORMATION

A disc brake assembly is used as standard equipment on W350 models. The brake assembly includes a single piston sliding caliper, caliper to steering knuckle adapter, ventilated rotor and a splash shield. The splash shield which is bolted to the adapter protects the bearings and inboard surface of the rotor from road splash. The wheel protects the outboard surface of the rotor and brake assembly (Fig. 1).

The caliper attaches to and slides on machined ways within the adapter, which is attached to the steering knuckle (Fig. 2).

The inner shoe and lining is installed with the ends of the shoe in the adapter. An anti-rattle spring is positioned between the leading edge of the shoe and the adapter at the bottom of the caliper (Fig. 8).

The outer shoe and lining is installed with the shoe flanges bearing against the shoe locating and torque abutment surfaces on the caliper (Fig. 7). The linings are riveted to the shoes, and the inner and outer shoes are not interchangeable.

The caliper housing (Fig. 3) is a single piece casting which is positioned on the adapter against machined surfaces at the trailing end. A caliper support key is installed between the leading edge of the caliper and the adapter with a support spring inserted between the key and the caliper. A key retaining screw keeps the key from sliding out of the anchor bracket.

A single hydraulic piston is inserted into the cylinder bore in the caliper housing with the hydraulic fluid inlet coming into the bottom of the bore. A square section seal is fitted into an annular groove in the cylinder bore, and a rubber boot is used to seal the piston and caliper bore from road splash and contamination. A bleeder screw is located above the cylinder bore to bleed air from the system.

Operation

When the brake pedal is depressed, brake fluid from the master cylinder is displaced into the caliper cylinder. This moves the piston outward and forces the

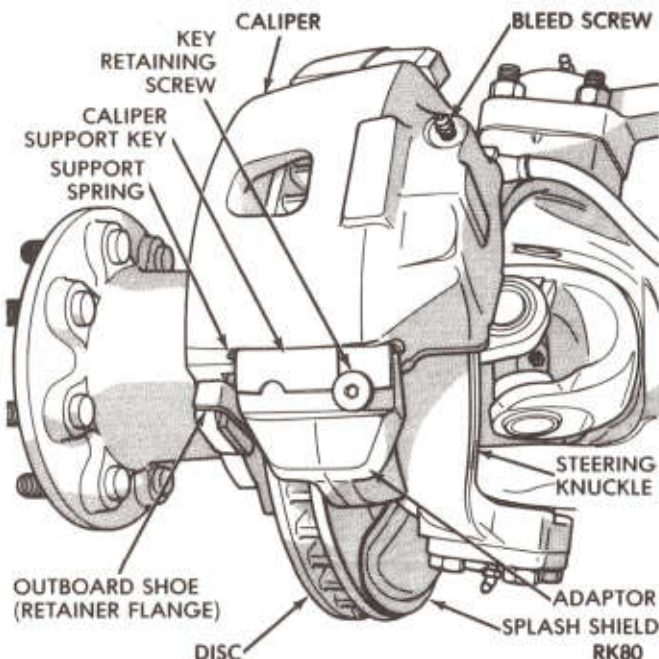


Fig. 1—Disc Brake Assembly (Rear View)

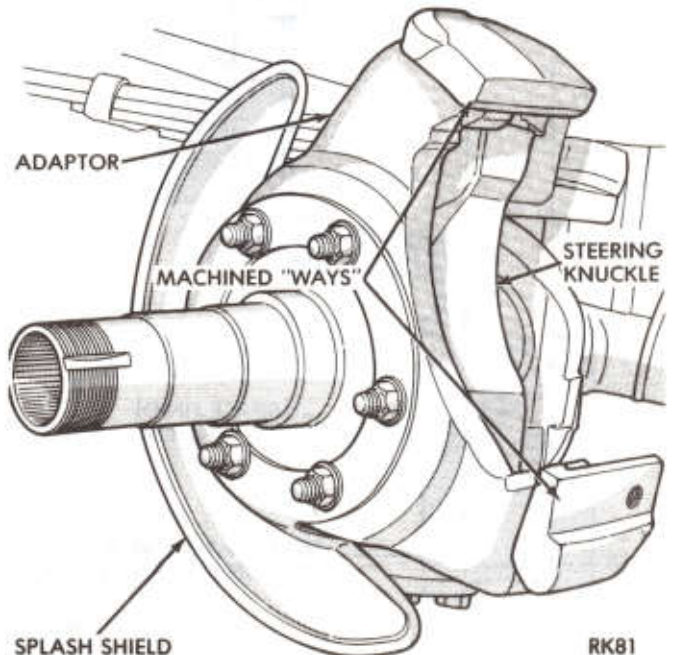


Fig. 2—Adapter/Steering Knuckle Attachment

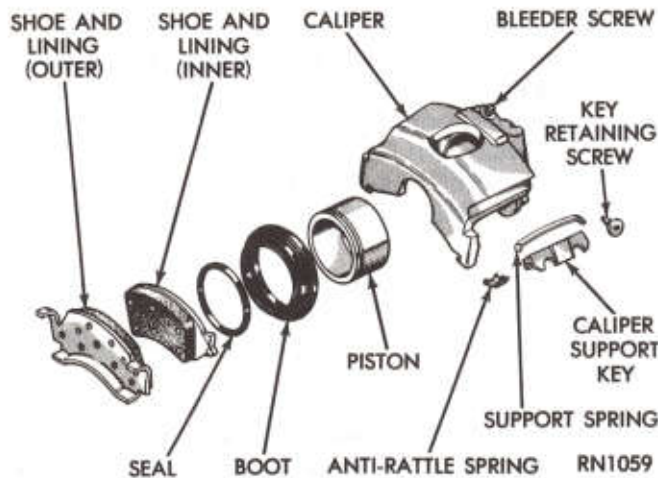


Fig. 3—Caliper Assembly

inner shoe and lining assembly against the inboard surface of the rotor.

The reaction of the inner lining pressing against the rotor moves the caliper housing slightly inboard. The outer legs of the caliper housing force the outer shoe and lining assembly against the outboard surface of the rotor.

The two shoe and lining assemblies clamp the rotor in a vise-type movement to provide the braking action. The braking torque is transferred from the linings to the shoes. The torque from the inner shoe is transferred directly to the anchor bracket, while the torque from the outer shoe is transferred through the caliper to the anchor bracket.

When the brake pedal is released, the piston seal (distorted by applied pressure) retracts the piston into the cylinder (Fig. 4), leaving the caliper housing free to slide slightly outboard, thus releasing the brakes.

Automatic adjustment is obtained by outward relocation of the piston as the inboard lining wears and inward movement of the caliper as the outboard lining wears, thus maintaining correct adjustment at all times.

HOLD-OFF VALVES

Hold-off valves are used because of different braking characteristics between disc and drum brakes.

With disc brakes, brake application is immediate and braking response is directly proportional to pedal effort. Drum brake response occurs after piston travel, return spring stretch and shoe contact with the drum, then self energizing tends to multiply pedal effort.

Hold-off valves are used to momentarily hold off front (disc brake) hydraulic system pressure until rear drum brakes begin to apply.

For valve application and service, see "Hydraulic System Control Valves", this group.

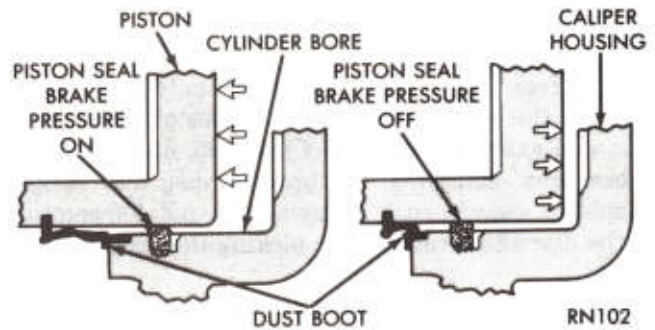


Fig. 4—Piston Seal Function for Automatic Adjustment

ROUTINE MAINTENANCE

Check Brake Lines, Hoses and Linings

Raise all four wheels. Remove front wheel and tire assemblies and inspect the braking disc, linings and caliper. Inspect brake flexible hose and tubing according to procedure outlined in "Brake Hose and Tubing."

Inspect brake linings on a regular basis. If the linings (pads) are worn to within .030 inch of the rivets, replace both sets of shoe and lining assemblies, (inboard and outboard) on the front wheels. It is necessary that both front wheel sets be replaced whenever a respective shoe and lining is worn beyond specifications or damaged.

Check all brake tube connections for possible leaks. Install new flexible hoses as required.

Check adapter plate to knuckle bolts for specified torque.

Check the master cylinder fluid level at each lubrication period. Maintain fluid level to within 1/4 inch of the top of the reservoir. Use only clean brake fluid conforming to DOT 3.

Brake Roughness

The most common cause of brake roughness (or chatter) with disc brakes are excessive variation in disc thickness. This can be easily checked with a 2 in. micrometer (vernier type preferred). If this measurement is out of specification, the disc must be refinished or replaced. Refer to "Brake Disc", this Group.

Other less prevalent causes of roughness can be the use of some types of non-standard lining and extreme abrasion of the disc faces. Also, vehicles which stand unused for periods of time in areas of high humidity or salt air may incur rust on the disc which could cause a temporary brake surge and roughness. Normally however, this condition should correct itself after a short period of usage. If rust is severe enough roughness will not clear up and the disc must be refinished or replaced.

DISC BRAKE SERVICE PRECAUTIONS

(1) Grease or any other foreign material must be kept off the caliper assembly, surfaces of the braking disc and external surfaces of the hub, during service procedures. Handling the braking disc and caliper should be done in such a way as to avoid deformation of the disc and scratching or nicking the brake linings (pads).

(2) If inspection reveals that the square sectioned caliper piston seal is worn or damaged, it should be replaced immediately.

(3) During removal and installation of a wheel and tire assembly, use care not to strike the caliper.

(4) The front wheel bearing end play is important and must be within specifications.

(5) Be sure vehicle is centered on the hoist before servicing any of the front end components to avoid bending or damaging disc splash shield on full right or

left hand turns.

(6) Before vehicle is moved after any brake service work, **be sure and obtain a firm brake pedal** by using proper bleeding procedures: see "Hydraulic System Control Valves", this Group.

(7) Dragging the brakes (common result of left foot application) should be avoided during vehicle operation.

(8) The wheel, tire, hub, and disc assembly **cannot** be removed as an assembly. The caliper assembly must be removed before removal of the hub and disc assembly.

(9) As lining wears, reservoir level will go down. If fluid has been added between relines, then reservoir overflow may occur when the piston is pushed back into the new lining position. Overflowing can be avoided in this case by removal of a small amount of fluid before overflow occurs.

SERVICE PROCEDURES

BRAKE SHOE-CALIPER INSPECTION

The brake linings should be inspected any time the wheels and tires are removed.

(1) Raise and support vehicle on a hoist or jackstand.

(2) Remove the tire and wheel, and visually inspect the outboard shoe linings at each end; normally the highest rate of wear occurs here. Inspect lining thickness on inboard shoe by looking down through caliper inspection hole. If the lining thickness at the thinnest point appears to be .030 (.762mm) inch or less above the rivet heads, remove the shoes and linings as outlined under "Brake Shoe Removal."

(3) Visually inspect the caliper for fluid leakage or other defects. If there is leakage, the caliper assembly should be overhauled as described under "Caliper Overhaul."

BRAKE SHOE REMOVAL

(1) Siphon part of the brake fluid from the master cylinder reservoir supplying the front disc brakes; leave reservoir 1/3 full. When the caliper pistons are pressed back into the cylinder bores, brake fluid may overflow if fluid is not removed. Discard the fluid removed.

(2) Raise and support vehicle on hoist or jackstands, and remove wheel and tire assemblies.

(3) Place a large C-Clamp on the caliper as shown in Figure 5, and tighten the clamp to bottom the caliper piston in the cylinder bore. Then remove the clamp. This will also partially remove the outer shoe off the caliper retention surfaces.

(4) Remove the key retaining screw (Fig. 1) and use a brass rod and light hammer to drive out the caliper

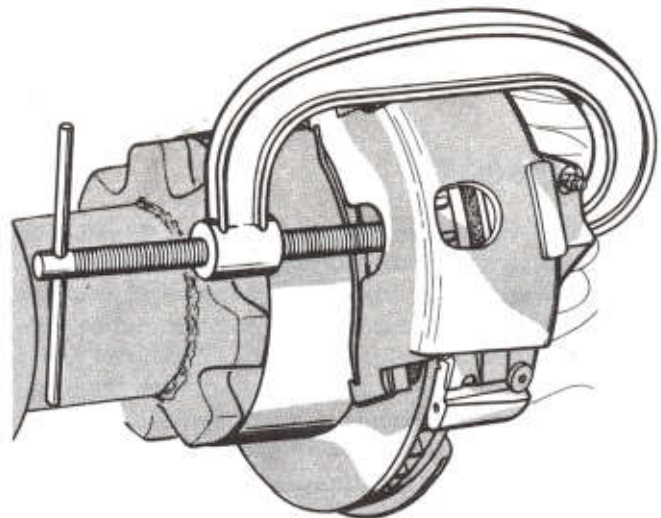
support key and caliper support spring (Fig. 6).

It is not necessary to disconnect the hydraulic line to the caliper; thus, it should not be necessary to bleed the brakes after the new shoes and linings are installed.

(5) Remove the caliper from the adapter and tap or pry the outer shoe and lining from the caliper (Fig. 7). Hang the caliper from a heavy wire or support on the front suspension. **Do not let the caliper hang with the weight of the caliper on the brake hose.**

(6) Remove the inner shoe and lining from the adapter, and remove the shoe anti-rattle spring (Fig. 8).

Mark shoe position if shoes are to be reinstalled.



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Fig. 5—Pushing Piston into Bore with "C" Clamp

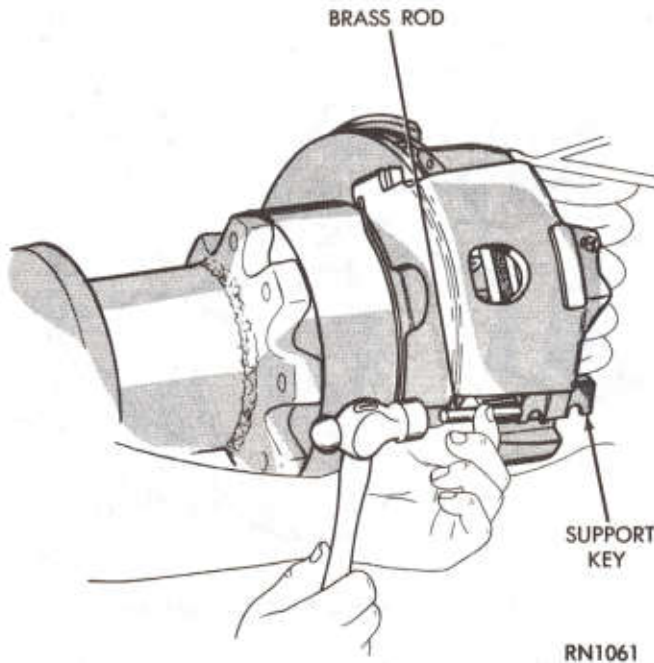


Fig. 6—Removing Caliper Support Key

CLEANING AND INSPECTION

(1) Examine linings for wear, shoes should be replaced if the lining (pads) are worn to within .030 inch of the rivet heads.

(2) Examine inside of caliper for piston leaks (evident by brake fluid in and around boot area and inboard lining), and for any rupture of piston seal boot. If boot is damaged or fluid leaks are evident, it will be necessary to overhaul caliper.

(3) Use a wire brush to remove any rust or corrosion from the machined surfaces of the adaptor and

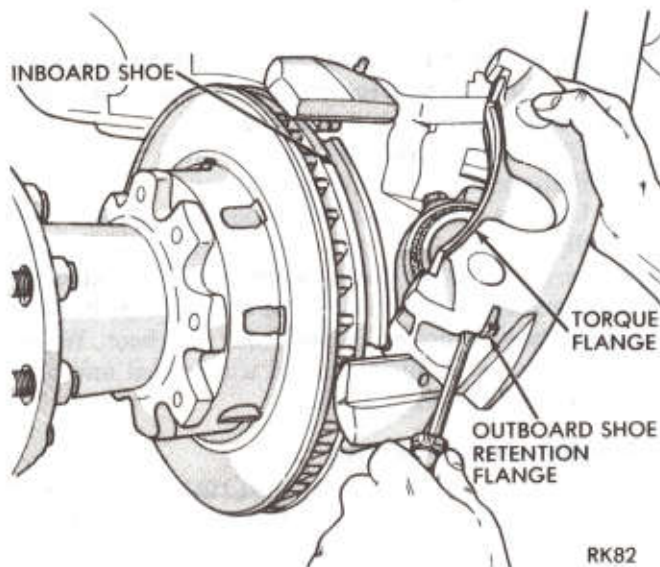


Fig. 7—Removing Outboard Shoe from Caliper

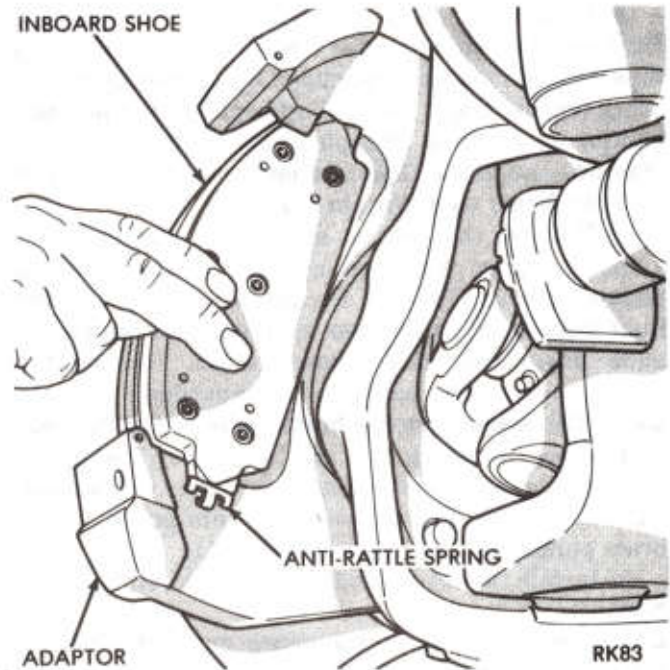


Fig. 8—Removing or Installing Inboard Shoe

caliper. It is important to clean these sliding/contact surfaces.

BRAKE SHOE INSTALLATION

If original brake shoes are to be reinstalled, they must be reinstalled in the original position as marked.

(1) Position the anti-rattle spring in the lower shoe abutment of the adapter (Fig. 8). Be sure that the loop portion of the spring is positioned away from the rotor. Install the lower end of the inboard shoe into the groove provided in the adapter (against the spring clip). Slide the upper end of the shoe into position. Be sure the clip remains in position.

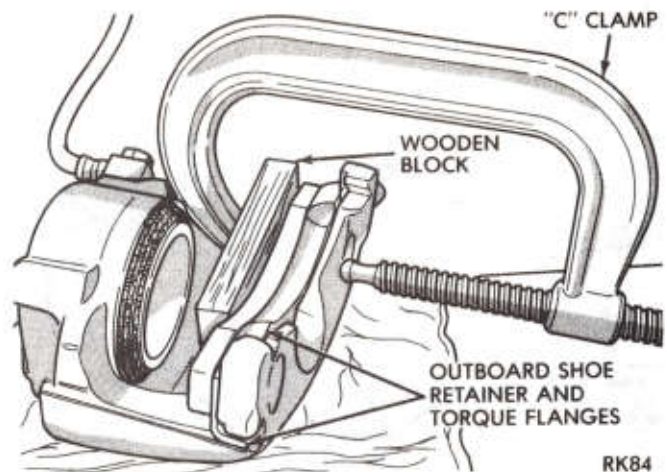


Fig. 9—Pressing Outboard Shoe onto Caliper Arms with "C" Clamp

(2) Position the outer shoe and lining on the caliper. **No free play should exist between shoe retaining flanges and machined surfaces on caliper outboard arms (which might cause shoe rattle). If the shoe cannot be pressed into place by hand, a C-Clamp may be used. If a C-Clamp is used, protect shoe with wooden block as shown in Figure 9.**

(3) Position the caliper over the brake disc and guide the upper caliper groove into the upper mating adapter groove (Fig. 10). **Be careful not to pull the dust boot from its groove as the piston and boot slide down over the inboard shoe.** Position the caliper to the lower adapter sliding surface.

CAUTION: Make sure the brake hose is not twisted.

(4) Place the spring over the caliper key, install the assembly between the adapter and lower caliper machined surfaces. Tap the assembly into position with brass punch and light hammer (Fig. 11).

(5) Install the screw and torque to 15 ft. lbs (20.3 N·m).

CAUTION: The boss on the screw must fit fully into the cutout on the key.

(6) Reinstall wheel and tire assembly and lower vehicle. Add fluid to master cylinder reservoir to bring fluid level to within 1/4 inch (6.25mm) of the top of the reservoir.

Pump brake pedal several times and recheck master cylinder fluid level; replenish if necessary. Do not move vehicle until a firm pedal has been obtained and master cylinder fluid level is correct.

CALIPER OVERHAUL

Caliper-Piston Removal

(1) Raise vehicle and support on hoist or jackstands. Remove wheel and tire assembly.

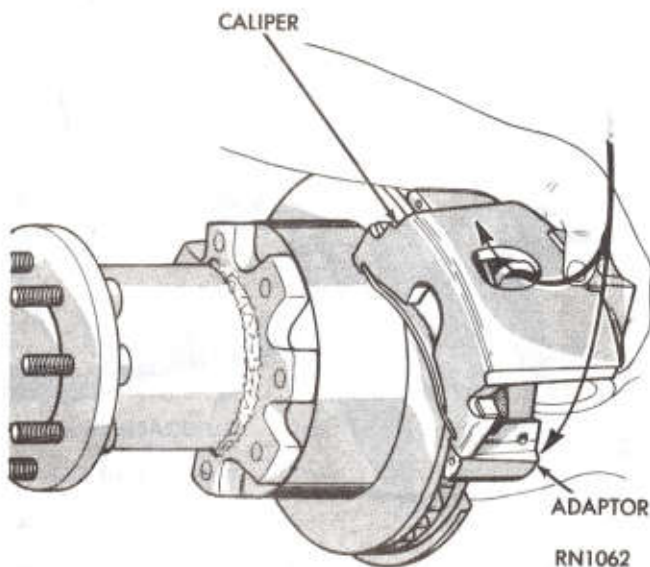


Fig. 10—Installing Key on Adaptor

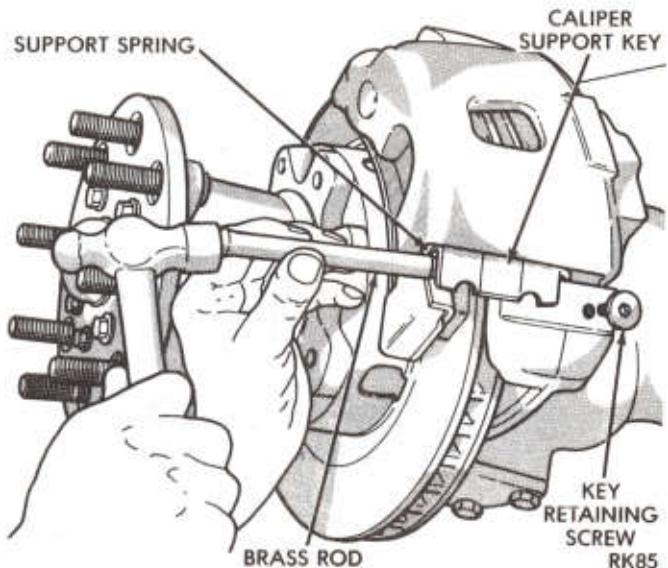


Fig. 11—Installing Key and Spring

(2) Clean brake hose and tubing connections at caliper and brake line.

(3) Remove caliper from adapter and brake shoes from caliper and adapter as described under "Brake shoe Removal". **Do not disconnect hydraulic brake hose from brake line or caliper.**

(4) Support caliper on front axle assembly on shop towels to absorb any hydraulic fluid loss. **Carefully** depress brake pedal to hydraulically push piston out of bore (brake pedal will fall away when piston has passed cylinder bore opening). Prop brake pedal to any position below the first inch of pedal travel to prevent loss of brake fluid. (If both front caliper pistons are to be removed, disconnect flexible brake hose at frame bracket after removing first piston. Plug brake tube to remove piston from opposite caliper.)

CAUTION: Under no condition should air pressure be used to remove piston from bore. Personal injury could result from such a practice.

(5) Disconnect brake flexible hose from caliper.

(6) Remove boot from piston.

(7) Using a small pointed wooden or plastic rod, carefully remove the piston seal from the caliper cylinder bore. **Do not use a metal tool of any kind for this operation as it may damage the cylinder bore or burr the seal groove.** Discard seal and boot. Whenever the caliper is disassembled a new seal and boot must be used for reassembly.

Cleaning and Inspection

(1) Use a wire brush to clean all rust and corrosion from the machined surfaces of the caliper housing; (do not use wire brush in cylinder bore).

(2) Clean all parts using denatured alcohol and blow dry with clean (oil free) air. Blow out all drilled

passages. Be sure that the cylinder bore is free of foreign matter and corrosion, especially in the seal area. If corrosion is present in the boot or seal groove, use a fiber brush to remove it.

(3) Inspect the cylinder bore, seal and boot groove and the piston for damage or excessive wear. Replace the piston if it is pitted, scored or the plating is severely worn. Bores that show light scratches or corrosion can usually be cleaned with crocus cloth. However, bores that have deep scratches or scoring should be honed, providing the diameter of the bore is not increased more than .002 inch (.050mm). If the bore does not clean up within this specification, a new caliper housing should be installed. Black stains on the piston are caused by piston seal and will do no harm. **When using a hone, coat the stones with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metallic rotary brush.**

Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper with brake fluid; wipe dry with a clean, lintless cloth, and then repeat cleaning a second time or until cloth shows no sign of discoloration.

(4) Use a wire brush to remove any rust or corrosion from the machined surfaces of the adapter.

(5) Inspect and clean the shoe anti-rattle spring, caliper support spring and caliper support key. Replace if damaged.

Assembly

(1) Clamp caliper in vise (with protector jaws). **Excessive vise pressure can cause bore distortion and**

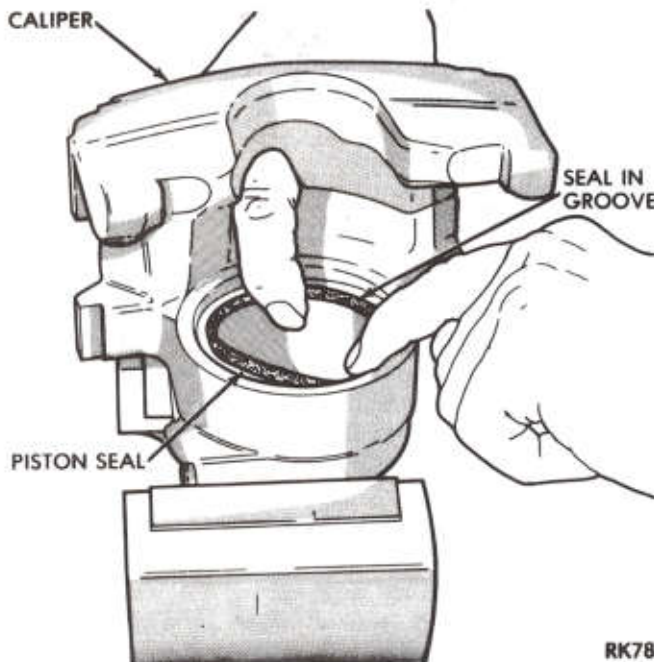


Fig. 12—Installing Piston Seal (Typical)

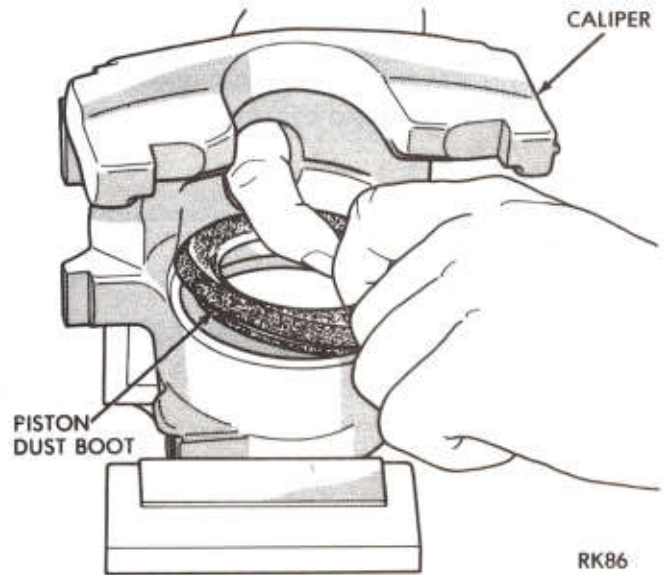


Fig. 13—Installing Piston Dust Boot (Typical)

binding of piston.

(2) Lubricate the new piston seal with clean brake fluid and position the seal in the groove in the cylinder bore. Position seal in one area of groove and gently work around and into the groove until properly seated. Be sure seal is not twisted or rolled (Fig. 12).

(3) Coat new piston boot with brake fluid. Install in caliper by working into outer groove, using fingers only. (Boot will seem larger than diameter of groove, but will snap into place when properly positioned in groove (Fig. 13).

(4) Plug hydraulic fluid inlet to piston and bleeder screw hole, then coat piston with brake fluid. With fingers spreading boot, work piston into boot and press down on piston. (The entrapped air below piston

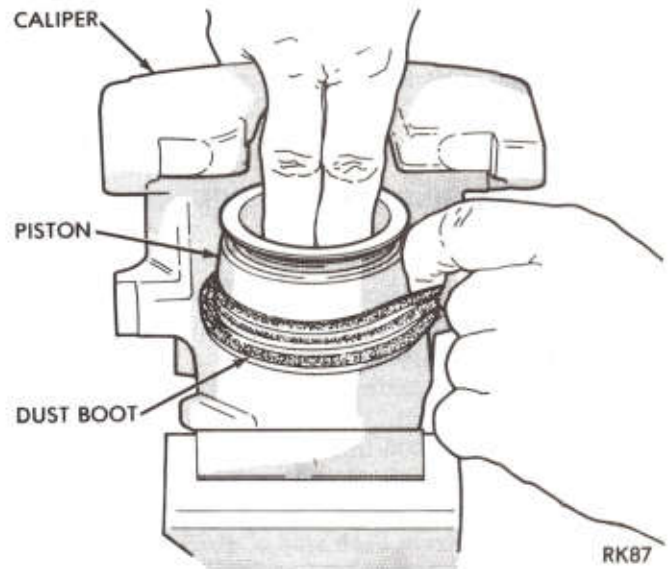


Fig. 14—Installing Piston through Boot (Typical)

will force boot around piston and into its groove as piston is depressed.) Remove plug, then carefully push piston down the bore until bottomed. **Force must be applied uniformly to avoid cocking piston** (Fig. 14).

Installation

(1) Install the shoe and lining assemblies as described under "Brake Shoe Installation."

(2) Connect hydraulic hose to brake line, torque to

specifications. Connect hydraulic hose to caliper (with new seal washers) and torque to specifications.

(3) Remove brake pedal prop, fill master cylinder reservoir (to within 1/4 inch (6.25mm) of top of reservoir. Open caliper, bleed screw and allow caliper to gravity fill with brake fluid. (Be sure all air bubbles have escaped.) Replenish brake fluid in master cylinder. Bleed brakes as described in "Hydraulic System Control Valves" in this group.

BRAKING DISC (ROTOR) - BENDIX (W250, and W350)

INDEX

	Page		Page
Checking Brake Disc for Runout	57	Installing Braking Disc and Hub	58
General Information	57	Refinishing (Refacing) Braking Disc	60
Inspection Diagnosis	57	Removing Braking Disc and Hub	58

GENERAL INFORMATION

Any servicing of the brake disc requires extreme care to maintain the brake disc within service tolerances to ensure proper brake action. This includes wheel bearing adjustment (front) after lubrication as well as any refinishing operations.

Inspection Diagnosis

Before refinishing or refacing a braking disc, the disc should be checked and inspected for the following conditions.

- (1) Scoring, rust, impregnation of lining material and worn ridges.
- (2) Runout or wobble.
- (3) Thickness variation (Parallelism).
- (4) Dishing or distortion (Flatness).

If a vehicle has not been driven for a period of time, the discs will rust in the area not covered by the

lining and cause noise and chatter. Excessive wear and scoring of the disc can cause temporary improper lining contact if ridges are not removed before installation of new lining (pads).

Some discoloration or wear of the disc surface is normal and does not require re-surfacing when linings are replaced.

Excessive runout or wobble in a disc can increase pedal travel due to piston knockback and increase seal bushing wear due to necessity of caliper to follow disc wobble.

Thickness variation in a disc can also result in pedal pulsation, chatter and surge due to variation in brake output when disc section is uneven. Dishing or distortion can be caused by extreme heat and abuse of the brakes.

SERVICE PROCEDURES

CHECKING BRAKING DISC FOR RUNOUT AND THICKNESS

(1) Mount dial indicator C-3339 on steering arm with plunger contacting disc approximately one (1) inch from edge of disc (Fig. 1).

(2) With wheel bearings adjusted to zero end play, check lateral runout. (Both sides of disc). Runout should not exceed .005 inch (.127mm). If runout is in excess of specification, install a new disc and hub assembly or reface disc, being careful to remove as little as possible from each side of disc. Remove equal amounts from each side of disc. Do not reduce thick-

ness below minimum thickness shown in refinishing section of this group. Be sure and readjust wheel bearings after check.

(3) Thickness variation measurements of disc should be made in conjunction with runout. Measure thickness of disc at twelve (12) equal points with a micrometer at a radius approximately one (1) inch (25.4mm) from edge of disc. If thickness measurements vary by more than .001 inch (.025mm), disc should be removed and resurfaced or a new disc and hub assembly installed (Fig. 1).

(4) Light scoring and/or wear is acceptable. If heavy scoring or warping is evident, the disc must be

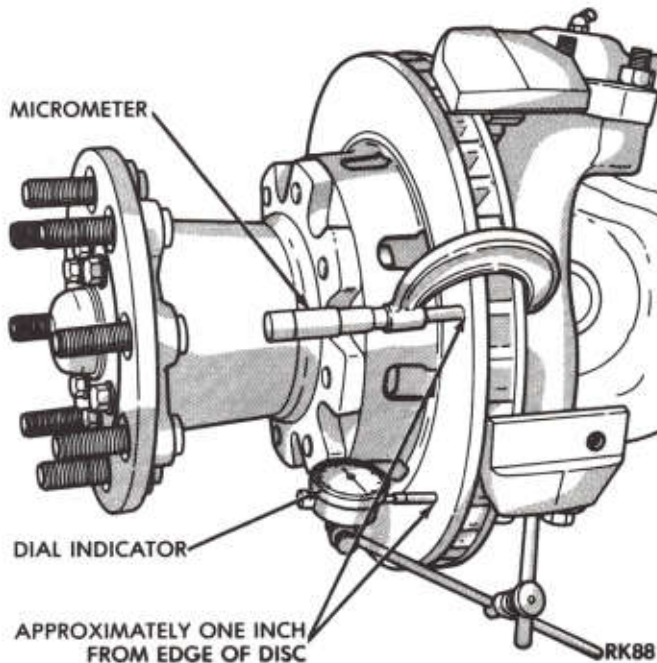


Fig. 1—Checking Braking Disc for Runout and Thickness

refinished or replaced (See Refinishing (Refacing) Braking Disc). If cracks are evident the hub and disc assembly must be replaced.

REMOVING BRAKING DISC AND HUB

- (1) Block brake pedal in the up position.
- (2) Raise vehicle to a comfortable working height and install jack stands.
- (3) Remove wheel and tire assembly.
- (4) Remove key retaining allen screw holding caliper to adapter (Fig. 2).
- (5) Tap adapter lock and spring from between caliper and adapter (Fig. 3).

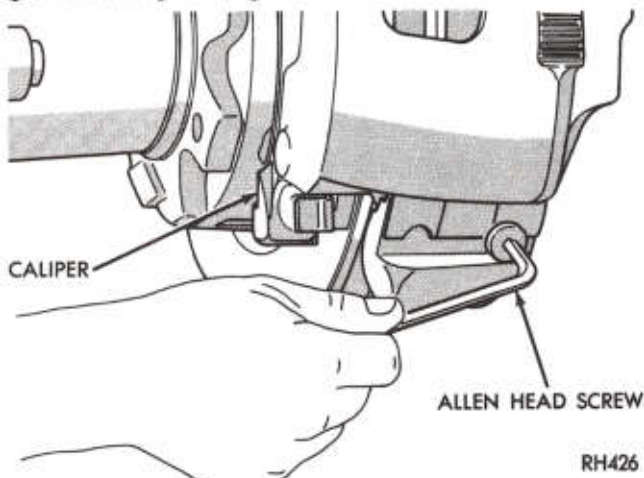


Fig. 2—Removing or Installing (Allen Head) Key Retaining Screw

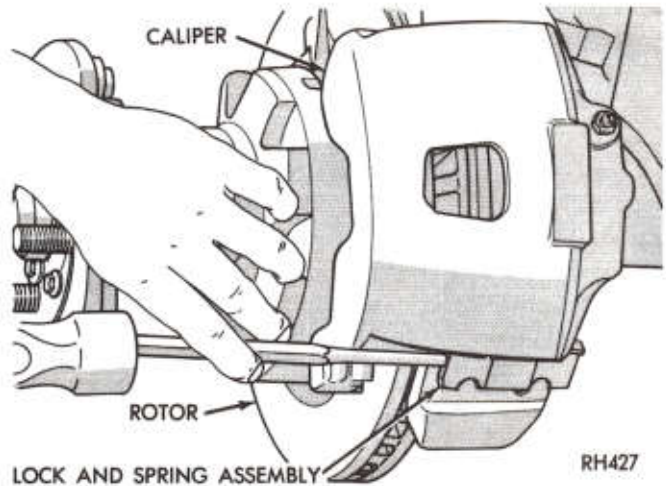


Fig. 3—Removing Caliper Lock and Spring

(6) Carefully separate caliper from adapter. Hang caliper out of the way. **Do not allow caliper to hang or be supported by hydraulic brake hose.** Inner brake shoe will remain on adapter.

(7) Remove hub cap. Using Tool C-4020 remove snap ring (Fig. 4).

(8) Remove flange nuts and lockwashers. Remove drive flange and discard gasket.

(9) Straighten tang on lockring and using Tool DD-1241-JD (Fig. 5), remove outer locknut, lockring, inner locknut and outer bearing. Carefully slide hub and rotor assembly from spindle.

INSTALLING BRAKING DISC AND HUB

Whenever the disc and hub is removed for brake service the bearings should be inspected and relubricated before reassembly, as follows.

- (1) Remove oil seal and inner bearing from hub.

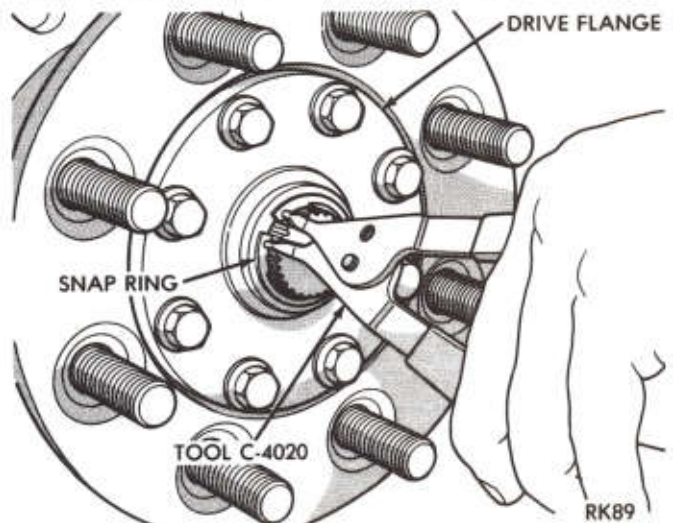


Fig. 4—Removing and Installing Snap Ring

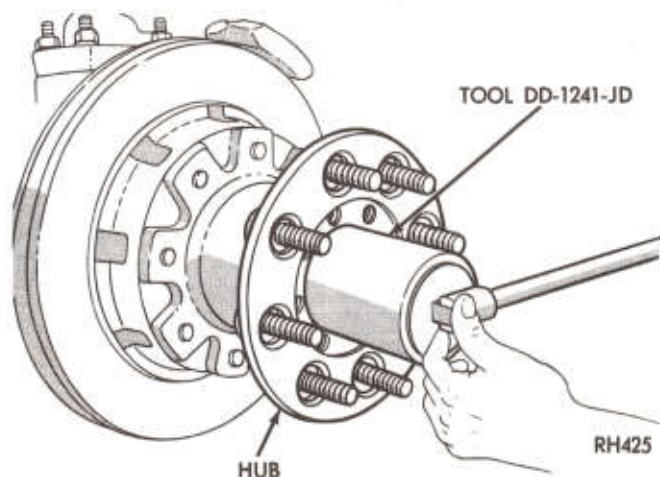


Fig. 5—Removing or Installing Outer Locknut

(2) Thoroughly clean bearings and interior of hub, removing all old grease. To clean bearings, soak them in cleaning solvent. Strike the flat of the bearings against a wooden block several times; immersing the bearings in the solvent between blows to jar and wash old particles of hardened grease from bearing. Repeat this operation until bearings are clean. Dry with compressed air but do not spin them with air. After cleaning, oil the bearings with engine oil. Turn the bearings slowly while applying pressure to test them for pitting and roughness. Replace all worn or defective bearings. If bearing shows pitting and roughness, replace cup and bearing. If bearings are suitable for further use, remove engine oil, pack with MOPAR Multi-Mileage Lubricant Part No. 4318062 or equivalent, and place them in a clean covered container until ready for installation. If a bearing packer is not available, hand pack grease into all cavities between cage and rollers.

(3) If bearings and cups are to be replaced. Remove cups from the hub with a brass drift or use suitable

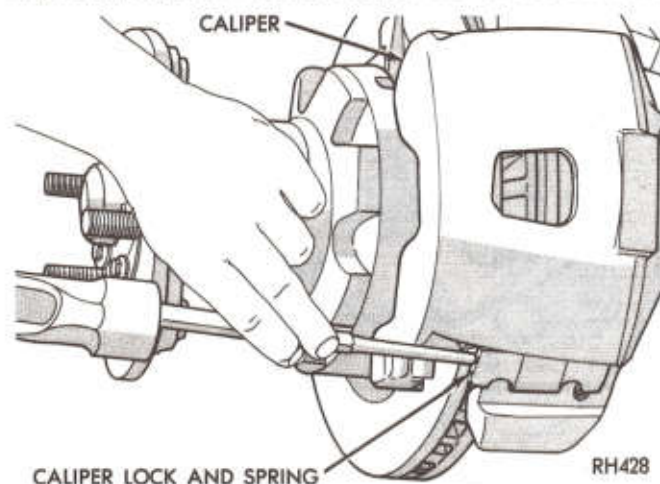


Fig. 6—Installing Caliper Lock and Spring

remover.

(4) Replace bearing cups with a suitable installer.

(5) Install inner bearing in grease coated hub and install new seal with a seal installer tool. Exercise extreme care not to damage seals when installing.

(6) Carefully install hub and rotor assembly onto

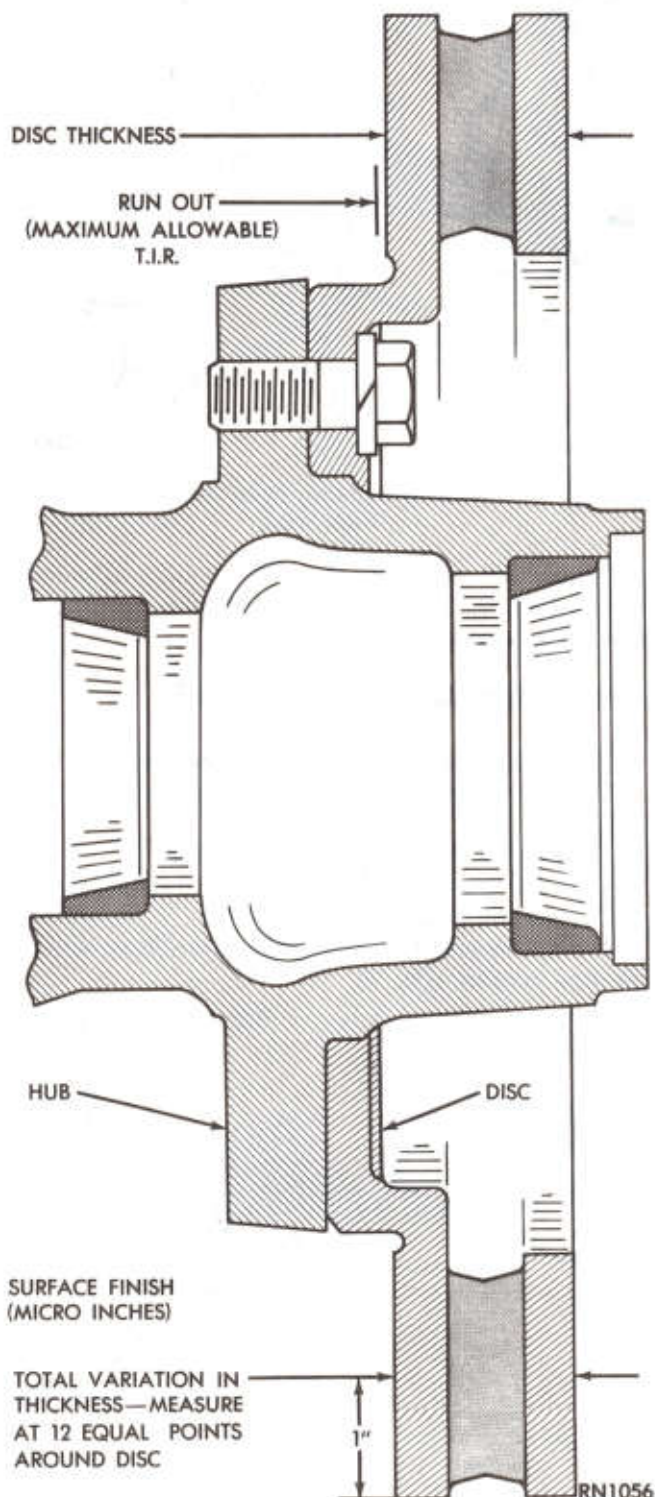


Fig. 7—Disc Specification Points (Typical)

grease coated spindle. Install outer bearing and inner lock nut.

(7) Using Tool DD-1241-JD and Tool C-3952, tighten to 50 ft. lbs. (67.7 N·m) to seat bearings, back off lock nut and retighten to 30 to 40 ft. lbs. (40.6 to 54.2 N·m) while rotating hub and rotor. Back nut off 135° to 150°. Assemble lockring and outer locknut. Tighten lock nut to 65 ft. lbs. (88.1 N·m) minimum. Bend one tang of lockring over inner locknut and one tang of lockring over outer locknut. Final bearing end play to be .001 to .010 inch (.025 to .254mm).

(8) Install new gasket on hub. Install drive flange, lockwashers and nuts. Tighten to 30 to 40 ft. lbs. (40.6 to 54.2 N·m). Using Tool C-4020 install snapping. Install hub cap.

(9) Carefully position caliper onto adapter. Position adapter lock and spring between caliper and adapter and tap into position (Fig. 6). Install allen screw and tighten to 15 ft. lbs. (20 N·m).

(10) Install wheel and tire assembly. Tighten nuts to specified torque (See Group 22).

(11) Lubricate at all fittings. Remove jack stands, lower vehicle, remove block from brake pedal and test vehicle operation.

REFINISHING (REFACING) BRAKING DISC

Resurfacing Braking Disc

This operation can be used when the disc surface is rusty or has lining deposits. A sanding disc attachment will remove surface contamination without removing much material. It will generally follow variations in thickness which are in the disc.

Refacing Braking Disc

Rotors do not have to be refaced every time a disc

brake is relined. If the rotor surface is deeply scored or warped or there is a complaint of brake roughness the rotor should be refaced.

When refacing a disc brake rotor the required .005 (.127mm) TIR (Total Indicator Reading) and .001 (.025mm) thickness variation **MUST BE MAINTAINED**. Extreme care in the operation of rotor turning equipment is required. The collets, shafts and adaptors on the lathe and the bearing cups in the rotor **MUST** be clean and free from any chips or contamination. When mounting the disc on the lathe strict attention to the manufacturer's instructions is required. If the disc is not mounted properly the runout will be worse after refacing than before refacing.

The use of a double straddle cutter which machines both sides of the disc at the same time is highly recommended.

Do not reface a disc brake rotor more than .030 inch less than the original disc minimum thickness. Reface both sides of rotor, not exceeding .030 total. Figure 7 shows the location of measurement and specifications when servicing the braking disc.

All rotors (disc) will show marking of minimum allowable thickness cast on the un-machined surface. This marking includes .030 inch (.762mm) allowable rotor wear beyond the recommended .030 inch (.762mm) of disc refacing.

Example:

Minimum Allowable Thickness	.940 (23.8mm)
Allow for Wear	.030 (.762mm)
Do Not Reface Beyond	.970 (24.6mm)

Model	Thickness	Thickness Variation	Runout	Micro Finish
W350	1.170/1.190	.001	.005	15-80
W250	(29.71/30.22mm)	(.025mm)	(.127mm)	(.381-.457)

SPECIFICATIONS FRONT WHEEL DISC BRAKES

Model Designation	AD150, AW150* D150, W150*	(2)D250	(3)D250 D350, W250	(1)W250 W350
Rotor				
Outside Diameter	11.75"(298mm)	12.82"(325.6mm)	12.82"(325.6mm)	12.88"(327mm)
Inside Diameter	7.775"(197mm)	8.86"(225mm)	8.86"(225mm)	8.80"(223mm)
Type	Ventilated	Ventilated	Ventilated	Ventilated
Thickness	1.25"(31.75mm)	1.25"(31.75mm)	1.19"(30mm)	1.19"(30mm)
Caliper—Make	Chrysler	Chrysler	Chrysler	Bendix
Type	Sliding	Sliding	Sliding	Sliding
Piston Diameter	3.10"(78.7mm)	3.10"(78.7mm)	3.10"(78.7mm)	3.38"(85.8mm)
Lining—Type	7163	7163	7163	7503J (chamfered)
Attachment	Riveted	Riveted	Riveted	Riveted
Swept Area (Pair)	218.5	249.4	249.4	245.2
Area (Per Axle)	40.1 Sq. In. (258.6cm ²)	40.1 Sq. In. (258.6cm ²)	41.7 Sq. In. (269cm ²)	49.5 Sq. In. (319cm ²)
Metering Valve Cut-In	117 PSI (806.7kPa)	117 PSI (806.7kPa)	117 PSI (806.7kPa)	117 PSI (806.7kPa)

*AW150, W150 Rotor O.D. 11.63" (295mm), I.D. 7.63" (194mm)

(1) With Spicer 60 Front Axle, (2) With 3300# Front Axle, (3) With 4000# Front Axle.

REAR WHEEL HYDRAULIC BRAKES

Model Designation	AD150, AW150 D150, W150	(1) D250, D350, W250, W350	(2) D350, W350
Size	11x2.5	12x2.5	12x3
Make	Chrysler	Bendix	Bendix
Type	Duo-Servo	Duo-Servo(BX)	Duo-Servo(BX)
Automatic Adjust	Yes	Yes	Yes
No. Cylinder per Wheel	1	1	1
Cylinder Bore	.938	1.00	1.125
Lining			
Thickness—Front	.195	.195	.195
Rear	.242	.258	.258
Arc per Shoe—Front	97°	110°-50'	110°-50'
Rear	124°-40'	123°-44'	123°-44'
Attachment	Riveted	Riveted	Riveted
Area per Axle	106.4	122.8	147.4
Drum Material	Composite	Cast Iron	Cast Iron

(1) With Spicer 60 Rear Axle.

(2) With Spicer 60 M Rear Axle.

MASTER CYLINDERS

Model Designation	D250 (1) W250 D150, W150	D350 (2) W250 W350
System	Dual	Dual
Cylinder Make	Chrysler	Bendix
	Aluminum	Cast Iron
Bore Diameter	1.125	1.125
Stroke	1.348	1.62

(1) With Spicer 44 Front Axle

(2) With Spicer 60 Front Axle

TIGHTENING REFERENCE

Location	Foot Lbs.	(N-m)	Inch Lbs.	(N-m)
WHEEL CYLINDER				
Rear Wheel Brake Support Axle Housing Bolt Nut .. 7/16	75	(101)		
1/20	85	(115)		
Wheel Cylinder Bleeder Bolt			95	(10.7)
Rear Wheel Cylinder Mounting Bolt			15	(1.8)
Front Wheel Brake Hose Mounting Bolt	35	(48)		
Flexible Brake Hose To Brake Line Tubes (All)			115-175	(12.9-19.7)
POWER BRAKE				
Power Brake Assembly to Dash			220	(25)
MASTER CYLINDER				
Pedal Shaft Screw Assembly			35	(4)
Master Cylinder to Booster			200 ± 30	(22.5)
HYDRAULIC BRAKE LINES				
Brake Line Tube Nuts, 3/8 or 7/16			115-175	(12.9-19.7)
1/2 or 9/16			140-200	(15.0-22.5)
Bottom attaching bolts	120	(162)		
DISC BRAKE (CHRYSLER)				
Adaptor Mounting Bolts D150-D250-AD150	110	(149)		
W150, AW150, W250	150	(203)		
D250 H.D., D350	160	(216)		
Retainer and Anti-Rattle Spring			200	(24.5)
DISC BRAKE (BENDIX)				
Adaptor Mounting Bolts W350 and W250 Extra	160	(216)		
Retainer Screw (key-lock)	15	(20.3)		

CLUTCH

WARNING: DUST AND DIRT ON CLUTCH PARTS GENERATED DURING NORMAL USE AND WEAR OF A MOTOR VEHICLE MAY CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM, SUCH AS ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING CLUTCH ASSEMBLIES OR COMPONENTS.

DO NOT CLEAN CLUTCH ASSEMBLIES OR COMPONENTS WITH COMPRESSED AIR OR BY DRY BRUSHING; USE A VACUUM CLEANER SPECIFICALLY RECOMMENDED FOR USE WITH ASBESTOS FIBERS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WET USING A WATER DAMPENED CLOTH.

DO NOT CREATE DUST BY SANDING A CLUTCH DISC UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

INDEX

	Page		Page
Cleaning and Inspection	3	General Information	1
Clutch Housing Installation	3	Service Procedures	2
Clutch Pedal and Bracket	1	Specifications	5
Clutch Release Mechanism	2	Tightening Reference	6

GENERAL INFORMATION

The clutches used are a single, dry disc type with no adjustment for wear being provided. Since the clutch housing has provisions for ventilation, condensation from steam vapors tend to accumulate on the internal clutch mechanism when the vehicle is steam cleaned. The facings of the disc will absorb moisture, and the force exerted by the pressure plate will bond the facings to flywheel and/or pressure plate, if the vehicle is allowed to stand for some time before use. If this condition occurs, it will necessitate replacement of disc assembly, flywheel, and/or clutch assembly. Immediately after cleaning operation, start engine and

"slip clutch" in order to dry off disc assembly, pressure plate, and flywheel.

Clutch Pedal and Bracket

The clutch pedal is connected to the release fork through a hydraulic master cylinder and slave cylinder (Fig. 1). The slave cylinder, master cylinder, and reservoir must be replaced as an assembly.

The upper end of the clutch pedal pivots in the pedal bracket on two nylon bushings. These bearings do not require periodic lubrication.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
CLUTCH CHATTER	(a) Worn or damaged disc assembly.	(a) Replace disc assembly.
	(b) Grease or oil on disc facings.	(b) Replace disc assembly and correct cause of contamination.
	(c) Improperly adjusted cover assembly.	(c) Replace cover assembly.
	(d) Broken or loose engine mounts.	(d) Replace or tighten mounts.
CLUTCH SLIPPING	(a) Burned, worn, or oil soaked facings.	(a) Replace disc assembly and correct cause of contamination.
	(b) Weak or broken pressure springs.	(b) Replace cover assembly.

(continued)

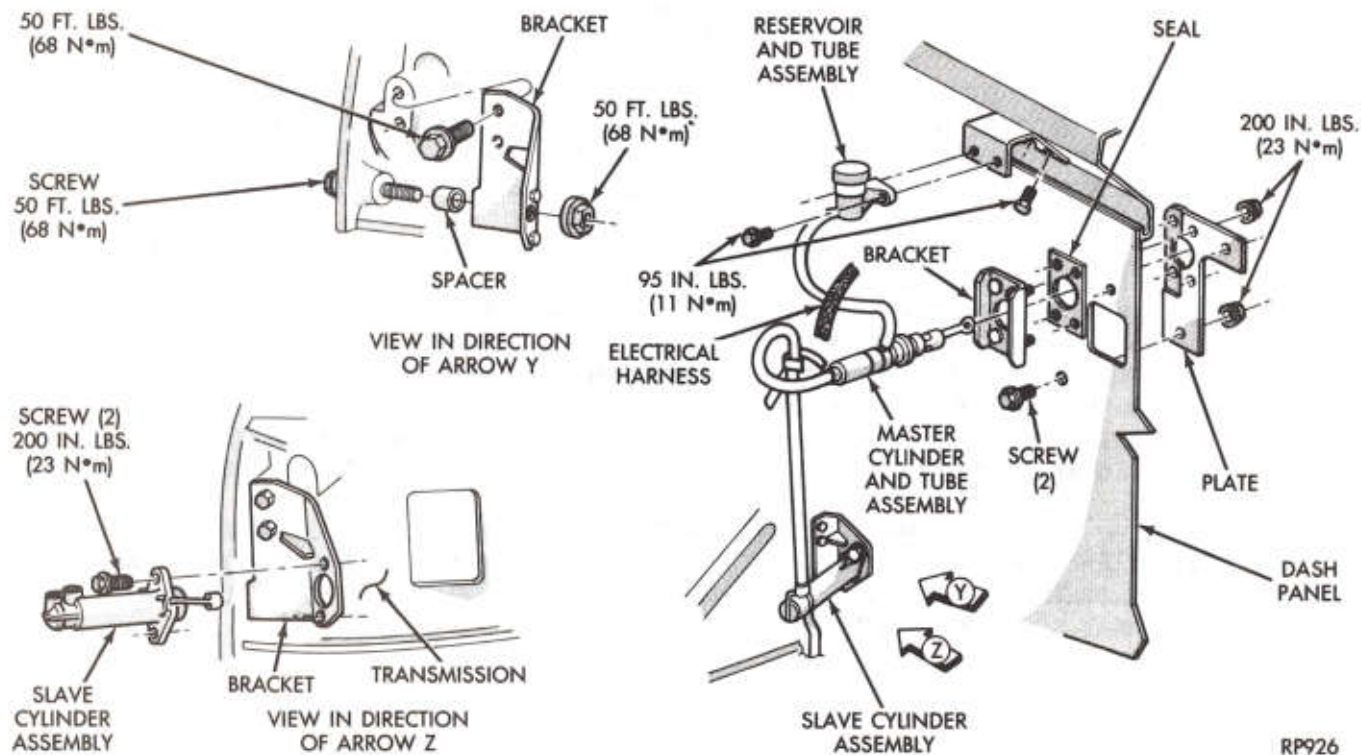


Fig. 1—Clutch Hydraulic Release Mechanism

Condition	Possible Cause	Correction
DIFFICULT GEAR SHIFTING	(a) Worn or damaged disc assembly.	(a) Replace disc assembly.
	(b) Improperly adjusted cover assembly.	(b) Replace cover assembly.
	(c) Clutch disc splines sticking.	(c) Remove disc assembly and free up splines or replace disc.
CLUTCH NOISY	(d) Worn or dry pilot bushing.	(d) Lubricate or replace bushing.
	(a) Worn release bearing.	(a) Replace release bearing.
	(b) Worn disc assembly.	(b) Replace disc assembly.
	(c) Worn release levers.	(c) Replace cover assembly.
	(d) Worn or dry pilot bushing.	(d) Lubricate or replace bushing.

SERVICE PROCEDURES

Improper operation or excessive wear may impair clutch function to a point where it may be necessary to remove and replace disc and/or cover assembly. Handle clutch and disc carefully to avoid contaminating friction surfaces.

Removal and Installation

- (1) Remove or install transmission. See "Group 21, Manual Transmission," for procedure.
- (2) Remove or install clutch housing, release fork, and bearing assembly (Fig. 2).
- (3) Mark clutch cover and flywheel, to maintain their same relative positions when reinstalling clutch assembly (Fig. 3).
- (4) Insert a spare transmission drive pinion through the clutch disc hub to prevent the clutch disc from falling and damaging facings (Fig. 4).

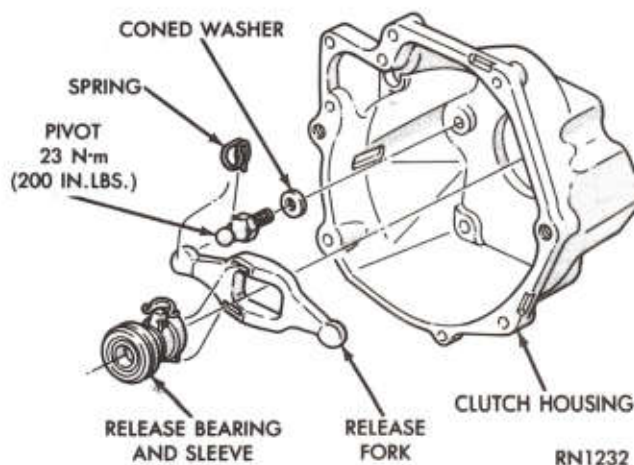


Fig. 2—Release Fork, Bearing, and Carrier

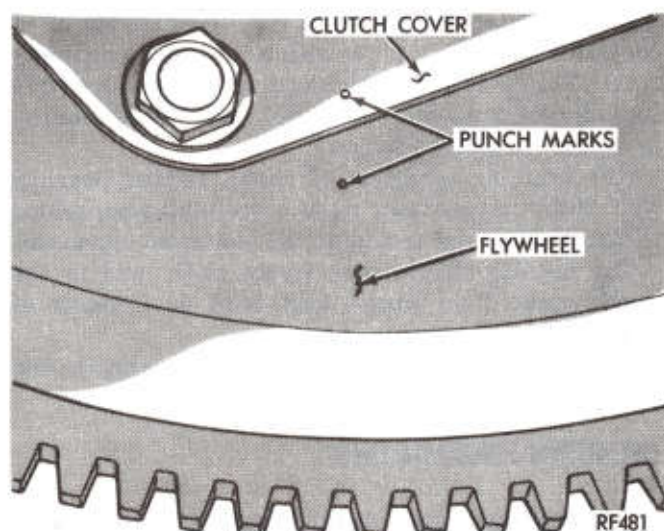


Fig. 3—Clutch and Flywheel Marking

(5) Loosen or tighten clutch cover attaching bolts, one or two turns at a time, in succession, to avoid bending the cover flange.

(6) Remove or install the clutch pressure plate and cover assembly and disc from flywheel. Handle carefully to avoid contaminating the friction surfaces.

(7) To reinstall, reverse the above procedure.

(8) Mount clutch assembly on flywheel, being careful to properly align dowels and the alignment marks made before removal. Apply pressure to the alignment tool to center the tip of the tool into the crankshaft while snugging the clutch attaching bolts sufficiently to hold the disc in position.

(9) To avoid distortion of the clutch cover, bolts should be tightened a few turns at a time, alternately, until they are all seated. Tighten to specifications. Remove clutch disc alignment tool.

Clutch Housing Installation

(1) Install clutch housing and torque all clutch-housing-to-engine-block bolts.

(2) Tighten strut-to-clutch-housing bolts.

(3) Tighten strut-to-engine-block bolts.

The transmission pilot bushing in end of crankshaft requires a grease that will stay in place during high-temperature operation. Use MOPAR Multipurpose Grease, Part Number 4318063 (or equivalent), which is a grease of this type and is recommended for all clutch lubrication points.

Cleaning and Inspection

WARNING: DUST AND DIRT ON CLUTCH PARTS GENERATED DURING NORMAL USE AND WEAR OF A MOTOR VEHICLE MAY CONTAIN ASBESTOS FIBERS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BOD-

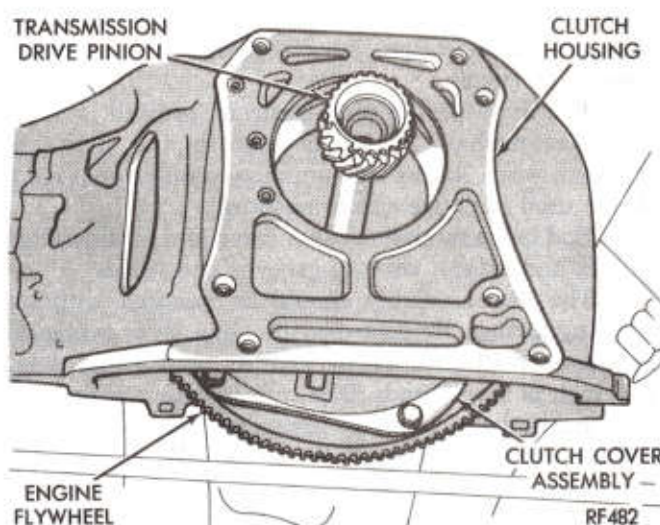


Fig. 4—Disc to Pilot Bushing Alignment

ILY HARM, SUCH AS ASBESTOSIS AND CANCER. EXTREME CARE SHOULD BE EXERCISED WHILE SERVICING CLUTCH ASSEMBLIES OR COMPONENTS.

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DO NOT CREATE DUST BY SANDING A CLUTCH DISC UNLESS SUCH OPERATION IS DONE WHILE USING PROPERLY EXHAUST VENTILATED EQUIPMENT.

DISPOSE OF ALL DUST AND DIRT SUSPECTED TO CONTAIN ANY ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE DUST EXPOSURE TO YOURSELF AND OTHERS.

FOLLOW ALL RECOMMENDED PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DIRT WHICH MAY CONTAIN ASBESTOS FIBERS.

(1) Inspect for oil leakage through engine rear main bearing oil seal and transmission drive pinion seal. If leakage is noted, it should be corrected at this time.

(2) Friction face of flywheel should have a uniform appearance throughout entire clutch contact area. If there is evidence of heavy contact on one portion of wear circle and a very light contact 180° from that portion, flywheel may be improperly mounted or sprung. In either case, a dial indicator mounted on clutch housing with plunger in contact with wear circle, should show **no more** than .003 inch runout throughout complete rotation of flywheel.

(3) Friction face of flywheel should also be free from excessive discoloration, burned areas, small cracks, grooves, or ridges.

(4) The drive pinion pilot bushing, pressed in rear end of crankshaft, should be smooth and show no excessive wear. A new transmission main drive pinion can be used to gauge size of bushing.

(5) End of transmission main drive pinion should be smooth and bright, without grooves and ridges.

(6) The disc assembly should be handled without touching facings. Replace disc if facings show evidence of grease or oil soakage, or wear to within less than .015 inch of rivet heads. The hub splines and splines on transmission main drive pinion should be a snug fit without signs of excessive wear. Metallic portions of disc assembly should be dry and clean and show no evidence of having been hot. Each of the arched springs between facings should be unbroken and all rivets should be tight.

(7) Wipe friction surface of pressure plate with kerosene, mineral spirits, or other suitable solvent.

(8) Using a straightedge, check pressure plate for flatness. The pressure plate friction area should be flat within .020 inch (.508mm) and free from discoloration, burned areas, cracks, grooves, or ridges.

(9) Inner ends of release levers should have a uniform wear pattern.

(10) Using a surface plate, test cover for flatness.

All sections around attaching bolt holes should be in contact with surface plate within .015 inch (.381mm).

(11) The cover should be a snug fit on pressure plate lugs. If cover assembly does not meet these requirements, it should be replaced.

(12) Examine condition of clutch release bearing. The clutch release bearing is a prelubricated, sealed thrust bearing and should not be immersed in solvent.

The bearing should turn freely when held in the hands under light thrust load, with no evidence of roughness.

(13) If bearing is noisy, rough, or dry, replace the complete bearing assembly with a new assembly.

CLEANING PRECAUTIONS

Condensation from steam vapors tend to accumulate on the internal clutch mechanism when the vehicle is steam cleaned. The facing of the disc will absorb moisture, and the force exerted by the pressure plate will bond the facings to flywheel and/or, pressure plate, if vehicle is allowed to stand for some time before use. If this condition occurs, it will necessitate replacement of disc assembly, flywheel, and/or clutch assembly. Immediately after cleaning operation, start engine and drive vehicle to normal clutch operating temperature in order to dry off disc assembly, pressure plate, and flywheel.

SPECIFICATIONS

10 Inch Clutch with 3.9L Engine

Model Disc (B&B)	14015	Facing Material	Woven Asbestos
Model Pressure Plate (B&B)	1672	Release Bearing	Permanently Lubricated
Actuation	Hydraulic		Ball
Facing—Thickness—Front	.125 inch	Pilot Bearing	Oilite Bushing
Thickness—Rear	.135 inch	Hub Spline Diameter	
No. of Pressure Springs	9	(23 Splines Rolled)	1.00 inch
Total Pressure (Lbs.)	1634	Vibration Damping Springs	6

11 Inch Clutch with 3.9L Engine

Model Disc (B&B)	14017	Release Bearing	Permanently Lubricated
Model Pressure Plate (B&B)	1649		Ball
Actuation	Hydraulic	Pilot Bearing	Oilite Bushing
Facing—Thickness	.140 inch	Hub Spline Diameter	
No. of Pressure Springs	9	(23 Splines Rolled)	1.00 inch
Total Pressure (Lbs.)	1848	Vibration Damping Springs	6
Facing Material	Woven Asbestos		

10-1/2 Inch Clutch with 5.2L Engine

Model Disc (B&B)	102-10883	Facing Material	Woven Asbestos
Model Pressure Plate (B&B)	106-10361	Release Bearing	Permanently Lubricated
Actuation	Hydraulic		Ball
Facing—Thickness—Front	.115 inch	Pilot Bearing	Oilite Bushing
—Rear	.135 inch	Hub Spline Diameter	
No. of Pressure Springs	12	(23 Splines Rolled)	1.00 inch
Total Pressure (Lbs.)	2028	Vibration Damping Springs	6

11 Inch Clutch with 5.2L Engine

Model Disc (B&B)	14018	Facing Material	Woven Asbestos
Model Pressure Plate (B&B)	106-10014	Release Bearing	Permanently Lubricated
Actuation	Hydraulic		Ball
Facing—Thickness	.140 inch	Pilot Bearing	Oilite Bushing
No. of Pressure Springs	12	Hub Spline Diameter	
Total Pressure (Lbs.)	2220	(23 Splines Rolled)	1.00 inch
		Vibration Damping Springs	6

11 Inch Clutch with 5.9L Engine

Model Disc (B&B)	102-10014	Facing Material	Woven Asbestos
Model Pressure Plate (B&B)	106-10014	Release Bearing	Permanently Lubricated
Actuation	Hydraulic		Ball
Facing—Thickness	.140 inch	Pilot Bearing	Oilite Bushing
No. of Pressure Springs	12	Hub Spline Diameter	
Total Pressure (Lbs.)	2220	(23 Splines Rolled)	1.00 inch
		Vibration Damping Springs	6

APPLICATION

Clutch Size	Transmission Speeds	Cover & Pressure Plate Assembly	Disc Assembly	Engine
10 inch	4	2239683	2908473	3.9L
10-1/2 inch	4	3681615	3743424	5.2L
11 inch	4	2409682	2908400	3.9L
11 inch	4	3496815	2909451	5.2L
11 inch	4	3496815	3633883	5.9L

COVER AND PRESSURE PLATE IDENTIFICATION

Clutch Size	Assembly Part Number	Plate Load in Pounds	Springs No. & Color	Mounting Bolt Circle Dia.
10 inch	2239683	1634	6 Orange, 3 Black	10-5/8 inch
10-1/2 inch	3681615	2028	3 White, 6 Black	11-5/8 inch
11 inch	2409682	1848	3 White, 6 Plain	12-5/8 inch
11 inch	3496815	2220	6 Plain, 3 Orange	12-5/8 inch

CLUTCH DISC IDENTIFICATION
(Spline Inside Diameter 15/16 inch)

Clutch Size	Assembly Part Number	Facing Diameter Outside x Inside	Springs Number & Color
10 inch	2908473	10" x 6"	6 Ivory
10-1/2 inch	3743424	10-1/2" x 6-1/2"	5 Green
11 inch	2908400	11" x 6-1/2"	3 Black, 3 Alum.
11 inch	2909451	11" x 6-1/2"	6 Purple
11 inch	3633883	11" x 6-1/2"	6 Red

TIGHTENING REFERENCE

	Foot Pounds	Newton Meters
Clutch Cover to Flywheel Bolts (5/16")	200*	23
Clutch Cover to Flywheel Bolts (3/8")	30	41
Clutch Fork Pivot Bolts	200*	23
Clutch Housing to Engine Bolts (3-8")	30	41
Clutch Housing to Engine Bolts (7/16")	50	68

*inch-pounds

	Foot Pounds	Newton Meters
Clutch Housing Pan Bolts	200*	23
Flywheel Bolts	55	75
Torque Shaft Ball Stud	60	81
Torque Shaft Ball Stud Bracket Bolts	30	41
Transmission to Clutch Housing Bolts	50	68

*inch-pounds

COOLING SYSTEM

CONTENTS

	Page		Page
DIAGNOSIS		COOLING SYSTEM, CLEAN, FLUSH,	
ACCESSORY DRIVE BELTS	18	REFILL	10
PRELIMINARY	2	ENGINE BLOCK HEATER	17
SYMPTOM (AND ACTION)	3	ENGINE THERMOSTAT	9
SYMPTOM DIAGNOSIS	4	FAN	15
GENERAL INFORMATION	1	FLUID FAN DRIVE	15
COOLING SYSTEM	1	PRESSURE TESTING RADIATOR CAP	13
SYSTEM COOLANT ROUTING	2	RADIATORS	13
SERVICE PROCEDURES	8	RADIATOR HOSES	14
BELT DRIVES	18	RADIATOR PRESSURE CAP	12
COOLANT PERFORMANCE	9	TESTING COOLANT SYSTEM FOR LEAKS .	11
COOLANT—LEVEL CHECK ROUTINE & SERVICE	10	THERMAL & ELECTRONIC IDLE SPEED CONTROL	16
COOLANT—ADDING COOLANT	10	TRANSMISSION OIL COOLER	14
COOLANT—DRAINING SYSTEM	10	WATER PUMPS	8
COOLANT—REFILLING SYSTEM	10	SPECIFICATIONS	20
COOLANT RESERVE SYSTEM (CRS)	12	TIGHTENING REFERENCE	20

GENERAL INFORMATION

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the breakdown of these designations is included in the Introduction Section at the front of this service manual.

Cooling System

The cooling system consists of a radiator, fan, (driven by engine) fan spacer (3.9L without air conditioning), fluid fan drive (with and without air conditioning) shroud, pressure cap, thermostat, coolant reserve system, transmission oil cooler, coolant, a water pump to circulate the coolant and hoses, and clamps to complete the circuit.

Its primary purpose is to maintain engine metal temperature in a range that will provide satisfactory engine performance, endurance, fuel economy, and emission levels under all expected driving conditions and ambient temperatures. It also provides hot water (coolant) for heater performance and cooling for automatic transmission oil. It does this by transferring heat from engine metal to coolant, moving this heated coolant to the radiator, and then transferring this heat to the ambient air.

Coolant flow circuits for 3.9L and 5.2L engines with water cooled intake manifolds are shown in Figure 1. Figure 1 (excluding intake manifold water cooling) is also "typical" for 5.9L engines.

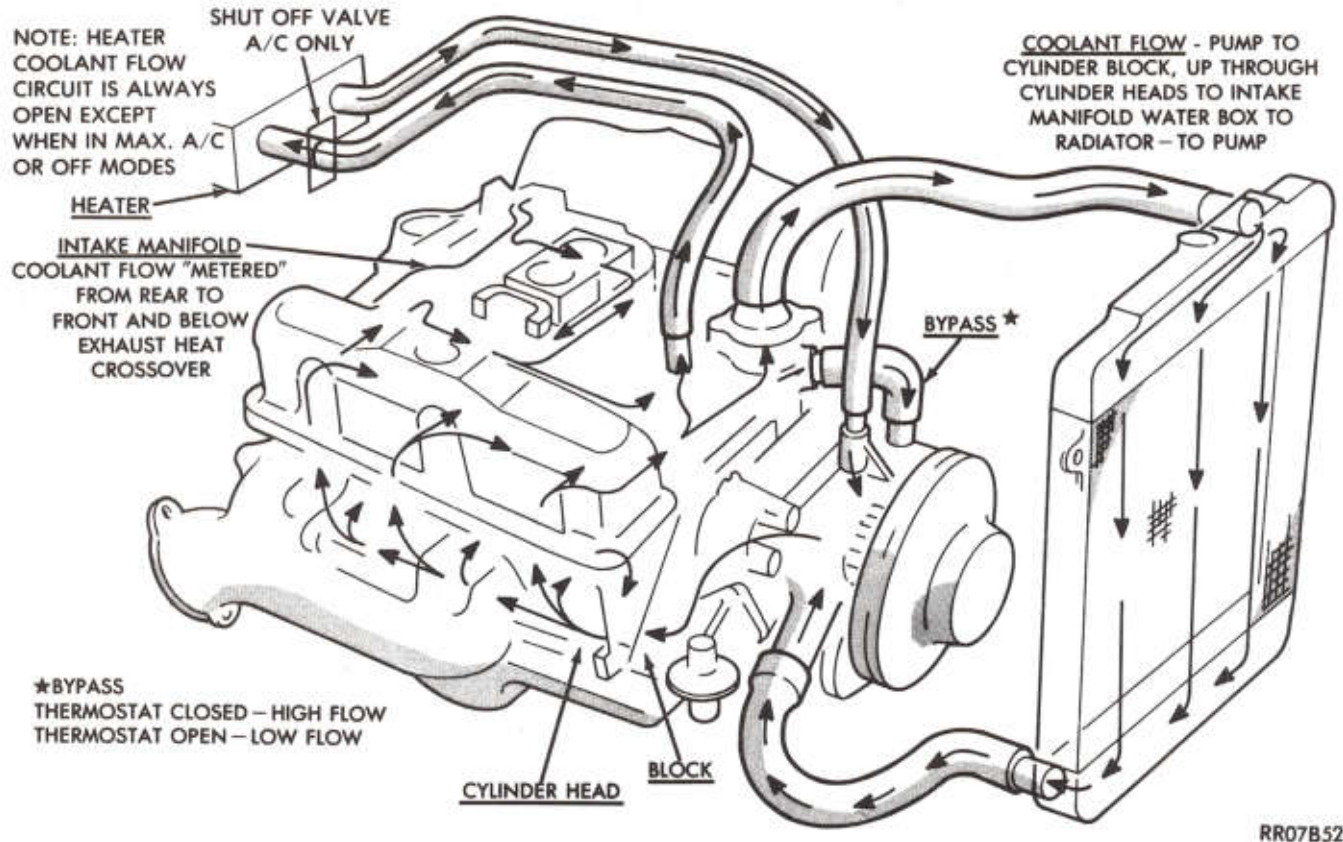


Fig. 1—Engine Cooling System (Typical)

PRELIMINARY

ENGINE COOLING SYSTEM OVERHEAT DIAGNOSIS

Establish what "driving" conditions caused this complaint. Abnormal loads on the cooling system, such as the following may be the problem:

1. PROLONGED IDLE, VERY HIGH AMBIENT TEMPERATURE, SLIGHT TAIL WIND AT IDLE, SLOW TRAFFIC, TRAFFIC JAMS, HIGH SPEED, STEEP GRADES:

Driving techniques that avoid overheating are;

- Idle with A/C off when temperature gauge is at end of normal range.
- Increasing engine speed for more air flow is recommended.

2. TRAILER TOWING:

Consult owner's manual — Trailer Towing. Do not exceed limits.

3. AIR CONDITIONING: ADD-ON or AFTER MARKET:

A maximum cooling package should have been ordered with the vehicle if add-on or after market A/C is involved. If not, maximum cooling components should be installed for the model involved per manufacturer's specifications.

Further diagnostic checks should not be required.

4. RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on the vehicle that may affect the cooling system such as engine adjustment (wrong timing), loose or slipping water pump belt, brakes (possibly dragging), changed

parts (possibly wrong), recored radiator or cooling system refilling (possibly under-filled or trapped air).

If investigation reveals none of the above as cause for overheating complaint refer to the following symptom and action chart.

SYMPTOM and ACTION

(See Preliminary FIRST)

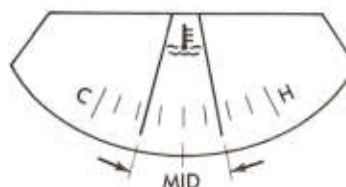
Symptom	Action
Blinking Engine Temperature Warning Light Or High Gauge Indication — Without Coolant Loss	Normal with temporary operation with heavy load, towing a light trailer, high outdoor temperatures, and/or on a steep grade.
Coolant Loss	Improper refilling procedures can result in trapped air in the system. Subsequent operation of the pressure cap and coolant recovery system will deaerate the cooling system. A low coolant level will then result in the Coolant Reserve Tank. Add coolant. If condition persists see System Diagnosis.
Hot Vehicle (Not Engine) Heat Damage Hot Carpet, Seat, Hot Catalytic Converter Smoke, Burnt Odor	Check heat shielding, exhaust system, emission controls, ignition timing — fuel/air ratio, misfiring.
Hot Engine Crackling Sounds Hot Smell Severe Local Hot Spots	A moderate amount of sound of heating metal can be expected with any vehicle. However, a crackling sound from the thermostat housing, a hot smell and/or severe local hot spots on an engine can indicate blocked coolant passages. Inspect for plugged water passages, bad casting, core sand and plugging, a cracked block or head, or a blown head gasket. Usually accompanied with coolant loss.
Coolant Color	Coolant color is not necessarily an indication of adequate temperature or corrosion protection. Some oily discoloration of the coolant recovery system bottle will occur due to the production use of soluble oil (also called water pump lubricant) which has been added for corrosion protection.
Coolant Recovery Bottle —Level Changes	Level changes are to be expected as coolant volume changes with engine temperature. If the level in the bottle is between the Maximum and Minimum marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures.
—Coolant NOT Returning	Coolant will not return to the radiator if the radiator cap vent valve does not function, if an air leak destroys vacuum, or if the overflow passage is blocked or restricted. Inspect all portions of the overflow passage, pressure cap, filler neck nipple, hose, and passages within the bottle for vacuum leak only. Coolant return failure will be evident by a low level in the radiator. Bottle level should increase during heat-up.

SYSTEM DIAGNOSIS

CONDITION—AND CHECKS

DIAGNOSIS

THERMAL 60° GAUGE (OPTIONAL) READS LOW



30 TO 40°
GAUGE TRAVEL
IS NORMAL

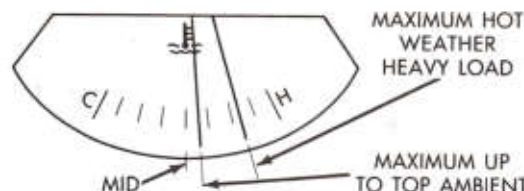
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Fig. 2—Normal Gauge Travel

- (1) Verify gauge, (Fig. 2) is temperature really low?
- (2) Is code 17 set in diagnostics? (For 3.9L & 5.2L engine only)
- (3) Does it read cold?
- (4) Coolant level low in cold ambient. (Also poor heater performance)
- (5) Coolant level O.K.

- (1) See Electrical, Group 8 and check temperature sending unit. Repair/Replace gauge or sending switch.
- (2) Yes—Change thermostat, No—Other problem, not thermostat.
- (3) Wiring disconnect, or wrong sending unit for lite switch, not gauge.
- (4) Check radiator and CRS for level—inspect for leaks.
- (5) Check heater controls, doors—see Group 24, Heaters and Air Conditioning.

GAUGE READS HIGH—Without Pressure Cap Blow off without Coolant or Steam from CRS Tank and to Ground



RR07B70

Fig. 3—Gauge Reading - Hot Weather - Heavy Load

- (1) Is it really reading high?
- (2) If at "H" without other signs of boiling.
- (3) Coolant Level low in Radiator and CRS.
- (4) Coolant level low in Radiator but not in CRS.
- (5) Check freeze point.
- (6) Assure Coolant Flow.

- (1) See Figure 3.
- (2) Look for Grounded gauge, sending unit or wire. See Group 8, Electrical.
- (3) a—Fill full remembering to air vent engine.
b—Inspect for leaks, repair.
c—Assure Pressure Cap was shut tight and seals at top and bottom of neck are functioning properly.
- (4) a—Fill full remembering to air vent engine.
b—Inspect for leaks and repair.
c—Inspect for leaks in CRS to radiator connection.
d—Assure cap seals at top and bottom.
- (5) a—Adjust to 50/50 Glyrol and water.
b—If no reading or below -50°F , mixture is too rich clean system before refilling.
- (6) a—Look for flow through filler neck with some coolant removed and thermostat open.
b—Repair water pump, if necessary see Water Pump Section.
c—Clean radiator if tubes are plugged.

SYSTEM DIAGNOSIS - CONTINUED

CONDITION—AND CHECKS

DIAGNOSIS

(7) Other possible causes.

(7) a—**High speed only**

- Radiator or Condenser air side plugged.
- Radiator core tubes plugged.
- Add on A/C without proper radiator.
- Engine out of tune (specifications).
- Brakes dragging.
- Bug screen.
- Trailer towing or hill climbing.

b—**High and Low Speed**

—Thermostat failed partially shut particularly if ambient temperature is below 70°F and vehicle has high mileage.

- Condenser or radiator air side plugged.
- Add on A/C.

c—**Low Speed—NOT high speed.**

- Check fan drive

TEMPERATURE GAUGE READS HOT, with Pressure Cap Blowoff and Steam and coolant to CRS and to Ground

(1) Coolant Level Low in Radiator and CRS.

- (2) Check Coolant Freeze point.
- (3) Assure Coolant Flow.

- (4) Thermostat failed shut.
- (5) Head Gasket Leak.

TEMPERATURE GAUGE IS INCONSISTENT, Cycles — Irratic

(1) Is cycle normal?

(1) a—Fill Cooling System Full and Air Vent.

b—Inspect for Leaks—repair.

c—Assure Pressure cap was shut and seals.

d—If low in radiator but not in CRS, also check connection to filler neck and pressure cap sealing.

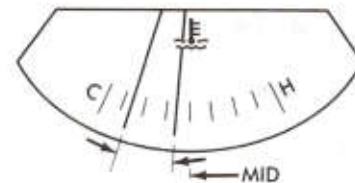
(2) Adjust to 50/50 Glycol and water, -35°F freeze point.

(3) a—Look for flow through radiator filler neck with coolant lowered and thermostat open.

b—When accompanied with "metal cracking sound"—consider core sand and/or bad head casting. Look for plugged core tubes.

(4) Especially in cold to medium ambient temperatures.

(5) Use block leak checker.



RR07B71

Fig. 4—Gauge Reaction to Thermostat

a—Normal Thermostat Cycle (Fig. 4).

SYSTEM DIAGNOSIS - CONTINUED**CONDITION—AND CHECKS****DIAGNOSIS**

RR07B72

Fig. 5—Gauge Reaction - Stop after Heavy Use

b—Hot water normal build up at stop after heavy use

(Fig. 5).

(2) Is coolant level low in radiator (Low level can trap air in system which can put thermostat pellet in air and it opens late).

(3) Is there a head gasket leak that puts exhaust gas in system? (This acts like trapped air with same effect as (2) above).

(4) Water pump impeller loose on shaft, slips sometimes.

(5) Air leak on suction side of water pump entraining Air; see 2 above.

(2) Fill system, and inspect for leaks.

(3) a—Test with block leak checker and replace if necessary.

b—Coolant in engine oil.

c—White steam coming out of exhaust.

(4) Replace.

(5) Find Leak and Repair.

WARNING LIGHT GLOWS ALL THE TIME**(No Gauge)**

(1) Check temperature sending unit. **The sending unit for a light is a switch and has a screwdriver slot in the electrode that is used for calibration. The gauge sending units do NOT have a screwdriver slot.**

(1) Is probably sending unit for gauge NOT for a light. (Light glows brighter at higher temperature.)

GAUGE; NO READING, THEN HOT INDICATION

(1) Gauge does not move until very hot, then moves immediately to "H" mark.

(1) Sending unit for light, not gauge.

PRESSURE CAP BLOW OFF, with steam to CRS and coolant to ground without high reading. Temperature Gauge above normal.

(1) Check pressure cap relief pressure.

(1) Replace if lower than 14 psi.

COOLANT LOSS TO GROUND without Pressure Cap Blow Off.

(1) Leaks.

(1) a—Pressure test system while shaking hoses.

b—Water pump seal—see "water pump", this Group.

SYSTEM DIAGNOSIS - CONTINUED**CONDITION—AND CHECKS****DIAGNOSIS****COOLANT LOSS PAST PRESSURE CAP TOP SEAL—****Glycol seen on Filler Neck**

(1) With normal gauge reading.

- (1) a—Cap not on tight.
- b—Top seal leaking.
- c—Cap diaphragm "oil canned".
- d—Filler neck damaged.
- e—Top rubber seal out of position.

(2) With high gauge reading or low gauge reading on new vehicle.

- (2) a—CRS Hose kinked.
- b—CRS tank plastic tube plugged.
- c—Pressure Cap Rubber seal out of position.

DETONATION OR PRE-IGNITION When Nothing to Cause It In Engine or Ignition(1) Check coolant freeze point—If no reading on Vuc check or below -50°F . Freeze point be aware that 100% Glycol makes engine metal run hotter even without a hot gauge reading.

- (1) a—Adjust coolant to 50/50 Glycol and water (-35°F).
- b—If 100% glycol has been found in the system. Clean and flush the system before replacing with 50/50 glycol and water.

HOSES OBSERVED COLLAPSING ON COOL DOWN

(1) Check pressure cap Vent Valve.

- (1) a—Must have stroke, Gasket swell can, prevent valve from opening.

b—Replace cap.

(2) Check CRS hose for kinking or plugging.

- (2) Repair as required.

(3) Inside of pressure cap plugged with stop leak pellet, or green silica gel, or fiberglass.

- (3) Clean cap.

FAN NOISY

(1) Check for loose fan blades.

- (1) Repair as necessary.

(2) Check for fan clearance to adjacent parts.

(3) Check for bent fan blades.

(4) Check for air obstructions on radiator or condensor.

(5) Check for failed viscous fan drive.

**INADEQUATE AIR CONDITIONING PERFORMANCE
— Cooling System Suspected**

(1) Check for plugged air side of condensor and radiator—front and rear.

- (1) Wash out with low velocity water (From fan side).

(2) Check for missing air seals—recirculating air path.

- (2) Repair as necessary.

(3) Assure correct cooling system parts.

HOT SMELL, Suspect Cooling System

(1) Was temperature gauge high?

- (1) a—Yes, See "Gauge Reads High".
- b—No, see 2, 3, and 4.

(2) Heat shields all in place?

- (2) a—Yes, See 3 and 4.
- b—No, repair as required.

(3) Heat exchanger air side plugged?

- (3) Clean as required.

(4) Catalytic converter - engine running rich.

- (4) Repair as required.

SYSTEM DIAGNOSIS

CONDITION—AND CHECKS

DIAGNOSIS

POOR DRIVEABILITY (Suspect Failed Open Thermostat)

(1) Check diagnostics—is code 17 set? 3.9L and 5.2L engines only.

POOR HEATER PERFORMANCE — Suspect Failed Open Thermostat?

(1) Does gauge read low?

(2) Check coolant level.

(3) Check diagnostics—is code 17 set (3.9L & 5.2L).

(1) a—If yes, change thermostat.

b—If not, see "Driveability" publications.

(1) a—See 3a.

(2) a—See 3a.

(3) a—If yes, change thermostat. If no—On 3.9L and 5.2L engines with air conditioning check heater shut off valve which should be open except in MAX A/C or OFF mode.

SERVICE PROCEDURES

WATER PUMPS

A quick test to tell whether or not the pump is working is to see if the heater warms properly. A defective pump will not be able to circulate heated coolant through the long heater hose.

The water pump on all models can be replaced without discharging the air conditioning system.

The water pump is serviced only as an assembly.

When replacing a water pump because of a bearing or shaft failure, the fan should be carefully checked for fatigue cracks, loose blades or rivets caused by excessive vibration. If any of these problems are found, the fan should be replaced.

The water pump can be removed and installed without discharging the air conditioning system.

Water Pump Removal-3.9L, 5.2L & 5.9L Engines

(1) Drain cooling system. If equipped with air conditioning, remove radiator.

(2) Loosen alternator adjusting pivot bolt and adjusting screw. Loosen power steering and air pumps, if so equipped. Remove all drive belts.

(3) On engines **without air conditioning** remove alternator bracket attaching bolts from water pump. Swing alternator out of the way and tighten pivot bolt.

(4) On engines **with air conditioning**, remove alternator, adjusting bracket, and power steering pump attaching bolts and set aside.

(5) Remove fan blade, spacer (or fluid unit), pulley and bolts as an assembly.

CAUTION: To prevent silicone fluid from draining into fan drive bearing and ruining the lubricant, do not place drive unit with shaft pointing downward (if so equipped).

(6) Disconnect heater and by-pass hoses.

(7) Remove air conditioning compressor pulley and field coil assembly.

(8) Remove water pump-to-compressor front mount bracket bolts and bracket.

(9) Remove pump retaining bolts and water pump assembly. Discard gasket and clean mating surfaces.

Water Pump Installation — 3.9L, 5.2L & 5.9L Engines

(1) Install a new by-pass hose, if necessary, with clamp positioned in the center of the hose.

(2) Install water pump using a new gasket. Tighten engine pump retainer bolts to 30 ft. lbs. (41 N·m). Rotate pump by hand to be sure it rotates freely.

(3) Install heater hose and position by-pass hose clamps.

(4) On engines **without air conditioning**, install alternator front bracket and tighten to 30 ft. lbs. (41 N·m).

(5) On engines **with air conditioning**, install compressor front bracket. Tighten compressor bracket bolts to 50 ft. lbs. (68 N·m) and water pump retainer bolts to 30 ft. lbs. (41 N·m). Install alternator, adjusting bracket and power steering pump. Tighten all bolts to 30 ft. lbs. (41 N·m). Install compressor clutch assembly.

(6) Install fan, spacer (or fluid unit), pulley and bolts as an assembly.

(7) Install belts and adjust tension as described in belt tightening procedures.

(8) Connect heater hose. Install radiator as outlined in this Section.

(9) Fill cooling system. See "Refilling Cooling System".

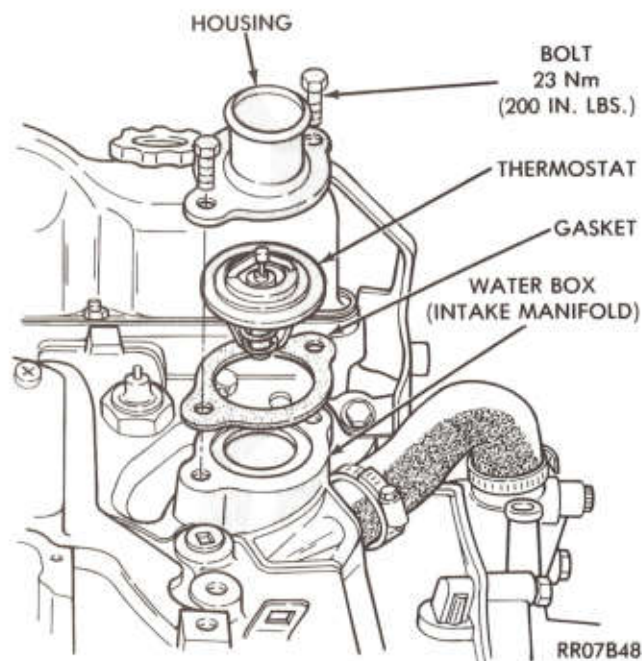


Fig. 6—Engine Thermostat (Typical)

ENGINE THERMOSTAT

The 3.9L, 5.2L and 5.9L engine thermostats are located in a water box, formed in the intake manifold at the front of the engine (Fig. 6).

These thermostats are equipped with an air bleed notch.

Description and Operation

The engine cooling thermostats are wax pellet driven, reverse poppet choke type. They are designed to provide the fastest warm up possible by preventing excessive leakage through them and to guarantee a minimum engine operating temperature of 88 to 93°C (192 to 199°F). They also automatically reach wide open so they do not restrict flow to the radiator as temperature of the coolant rises in hot weather to around 104°C (220°F). Above this temperature the coolant temperature is controlled by the radiator, fan, and ambient temperature, not the thermostat.

Operation and Testing

The thermostat is operated by a wax filled container (pellet) which is sealed so that when heated to a predetermined temperature the wax expands and overcoming closing spring and water pump pressure, forces the valve to the open position.

Coolant leakage into the pellet will cause a thermostat to fail open because the volume has been increased. They very rarely "stick." Do not attempt to free up a thermostat with a screwdriver.

The open too soon type failure mode is included in the onboard diagnosis. The check engine light will not be lit by an open too soon condition, but if it has failed

open, code 17 (3.9L and 5.2L) will be set. Do not change a thermostat for lack of heat by gauge or heater performance, unless code 17 is present, see diagnosis for other probable causes. Failing shut is the normal long term mode of failure, and normally, only on high mileage vehicles. The temperature gauge will indicate this, see diagnosis.

Thermostat Removal

Drain cooling system down to thermostat level or below. See "Draining Cooling System."

Remove thermostat housing bolts and housing.

Remove thermostat, discard gasket, and clean both gasket sealing surfaces.

Thermostat Installation

When replacing thermostat it is necessary that the specified thermostat be installed.

Place a new gasket (dipped in water) on the water box surface, center thermostat into opening in the intake manifold. Place housing over gasket and thermostat, making sure thermostat is in recess provided for it in the thermostat housing, and bolt housing to intake manifold, tighten bolts to 200 in. lbs. (23 N·m).

Refill cooling system (see "Refilling System").

COOLANT

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, particularly in the cylinder head area near the exhaust valves, then carry this heat to the radiator (and heater) where the tube/fin assemblies of these components can give it up to the air.

Coolant Performance

Performance is measurable. For heat transfer pure water excels (Formula = 1 btu per minute for each degree of temperature rise for each pound of water), but this formula is altered when necessary additives to control boiling, freezing, and corrosion are added as follows:

Pure Water (1 btu per minute) - Boils and freezes too easily and allows corrosion.

100% Glycol (.7 btu per minute) - Can cause hot engine and detonation. Also, raises freeze point to 0°F and since corrosion preventing chemicals won't dissolve in glycol (only water) they deposit in the system, especially radiator core tubes and, acting like insulation, can cause a temperature rise of over 300°F, enough to melt plastic and soften solder.

50/50 Glycol and Water (.82 btu per minute) - Recommended combination and provides freeze point of -35°F. The radiator, water pump, engine water jacket, radiator pressure cap, thermostat, temperature gauge and sending unit and heater are all designed and sized for 50/50 glycol.

Where required, a 56% glycol and 44% water mixture will provide a freeze point of -50°F .

CAUTION: Richer mixtures cannot be measured with field equipment which can lead to problems associated with 100% glycol.

Coolant Selection-Additives

The use of aluminum intake manifolds, and water pumps require special corrosion protection. Mopar, P/N 4267020, Prestone II, Peak or antifreeze containing "Alugard 340-2", or their equivalent are recommended for best engine cooling without corrosion, but only when mixed to a freeze point of -35°F to -50°F . If it loses color or becomes contaminated, drain, flush and replace with fresh properly mixed solution.

All models have a .25% emulsifiable oil added to the radiator at the factory to prevent solder corrosion.

Coolant Service

Coolant should be changed at 52,500 miles or three years, whichever occurs first, then every two years or 30,000 miles.

COOLANT LEVEL CHECK — ROUTINE

Do not remove radiator cap from routine coolant level inspections.

The coolant reserve system provides a quick visual method for determining the coolant level without removing the radiator cap. Simply observe, with the engine idling and warmed up to normal operating temperature, that the level of the coolant in the reserve tank (Fig. 8) is between the minimum and maximum marks.

ADDING ADDITIONAL COOLANT — ROUTINE

The radiator cap should not be removed. When additional coolant is needed to maintain this level, it should be added to the coolant reserve tank. Use only 50/50 concentration of ethylene glycol type antifreeze and water.

COOLANT LEVEL CHECK — SERVICE

The cooling system is closed and designed to maintain coolant level to the top of the radiator.

When vehicle servicing requires a coolant level, check in the radiator, first, with the engine **off** and **not** under pressure, drain several ounces of coolant from the radiator drain cock while observing the CRS (Coolant Reserve Tank). Coolant level in the CRS tank should drop slightly, if it does not, suspect an air leak in the radiator to CRS connection. Then remove the radiator cap. The radiator should be full to the top; if not, and also if the coolant level in the CRS tank is at

the "MIN" mark an air leak in the hose or connections to the CRS tank or radiator filler neck, or the pressure cap seal to the radiator fill neck leaks.

Low Coolant Level — Aeration

If the coolant level drops below the top of the radiator core tubes, air will be sucked into the water pump and coolant will become hotter.

Air in the coolant will also cause loss of flow through the heater.

Deaeration

Air can only be removed from the system by gathering under the pressure cap, so that on the next heat up it will be pushed past the pressure cap into the CRS tank by thermal expansion of the coolant, where it escapes to the atmosphere in the CRS tank and is replaced with solid coolant on cool down.

DRAINING COOLING SYSTEM

To drain cooling system move temperature selector for heater to "full on" with engine running (to provide vacuum for actuation). **Without removing radiator pressure cap and with system not under pressure**, and with engine off, open draincock. Coolant reserve tank (Fig. 8) should empty first, (if not, see Testing Cooling System for Leaks) remove radiator pressure cap.

REFILLING COOLING SYSTEM

First clean system to remove old glycol, see "Cooling System Cleaning."

Fill system, using antifreeze described in "Coolant." Fill 50% of capacity with 100% glycol, and then complete filling system with water.

Fill coolant reserve system to at least the "MAX" mark with 50/50 solution. Run engine until thermostat opens to mix glycol and water. It may be necessary to add coolant to the reserve tank to maintain coolant level between the "MAX" and "MIN" mark after three or four warm-up, cool down cycles and trapped air has been removed.

COOLING SYSTEM CLEANING, REVERSE FLUSHING

Cleaning

Drain cooling system (see: "Draining Cooling System") and refill with clean water (see "Refilling Cooling System"). Run engine with radiator cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty, fill, run and drain system again until water runs clear.

Reverse Flushing

Reverse flushing of the cooling system is the forcing

of water through the cooling system, using air pressure in a direction opposite to that of the normal flow of water. This is usually only necessary with very dirty systems with some evidence of partial plugging.

Reverse Flushing Radiator

Drain cooling system and remove radiator hoses from engine. Install suitable flushing gun in radiator lower hose. Fill radiator with clean water and turn on air in short blasts.

CAUTION: Internal radiator pressure must not exceed 20 psi (138 kPa) as damage to radiator may result. Continue this procedure until water runs clear.

Reverse Flushing Engine

Drain radiator (see: "Draining Cooling System") and remove hoses from radiator. Remove engine thermostat and reinstall thermostat housing. Install suitable flushing gun to thermostat housing hose. Turn on water, and when engine is filled, turn on air, but no higher than 20 psi (138 kPa) in short blasts. Allow engine to fill between blasts of air. Continue this procedure until water runs clean. Reinstall thermostat using a new housing gasket. Fill cooling system (See "Refilling Cooling System").

Chemical Cleaning

One type of corrosion encountered with aluminum components is aluminum hydroxide deposition. General overall corrosion of the aluminum head casting in the corrosion products that are carried to the radiator and deposit when cooled off. It appears as dark grey when wet but very white when dry. This corrosion can be removed with a two part cleaner (oxilac acid and neutralizer), available in auto parts outlets. Follow manufacturers directions for use, except when the acid is in the coolant it is recommended to run the vehicle for one extra hour.

TESTING COOLING SYSTEM FOR LEAKS

With engine not running, wipe the radiator filler neck sealing seat clean. The radiator should be full.

Attach the Tester Tool C-4080 to the radiator, as shown in (Fig. 7) and apply 15 psi (104 kPa) pressure. If the pressure drops more than 2 psi in 2 minutes inspect all points for external leaks.

All hoses, radiator and heater, should be shaken while at 15 psi since some leaks occur only while driving due to engine rock, etc.

If there are no external leaks, after the gauge dial shows a drop in pressure, detach the tester, start engine and run the engine to normal operating tem-

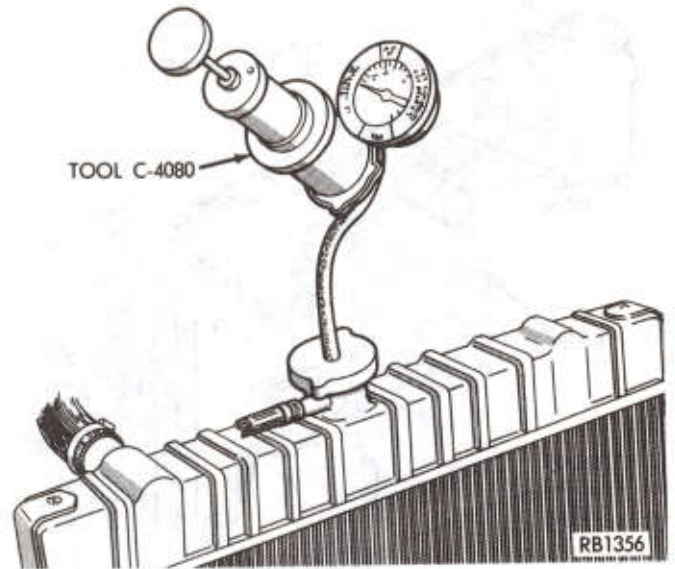


Fig. 7—Pressure Testing Cooling System

perature in order to open the thermostat and allow the coolant to expand. Reattach the tester, if the needle on the dial fluctuates it indicates a combustion leak, usually a head gasket leak.

WARNING: WITH TOOL IN PLACE PRESSURE BUILDS UP FAST. ANY EXCESSIVE AMOUNT OF PRESSURE BUILT UP BY CONTINUOUS ENGINE OPERATION MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 20 PSI (138 kPa).

Do not remove spark plug wires from plugs or by any other means short out cylinders if exhaust system is equipped with a catalytic converter.

If the needle on the dial does not fluctuate, race the engine a few times and if an abnormal amount of "coolant or steam" emits from the exhaust system at the tail pipe, it may indicate a leak that can be a faulty head gasket, cracked engine block, or cracked cylinder head.

If the above pressure test of the cooling system holds without fluctuation, then there is no leak, however, there may be internal leaks which can be determined by removing the oil dip-stick and if water globules appear intermixed with the oil it will indicate a serious internal leak in the engine. If there is an internal leak, the engine must be disassembled, the leak located and necessary new parts installed.

A convenient check for exhaust gas leakage into the cooling system is provided by a "block leak check" tool available thru automotive parts Jobbers. This tool has an indicator fluid in a container that is sealed into the radiator filler neck by a rubber cone, and by following the manufacturers recommendations to raise cylinder pressure the indicator fluid will change color if exhaust gas is present in the coolant.

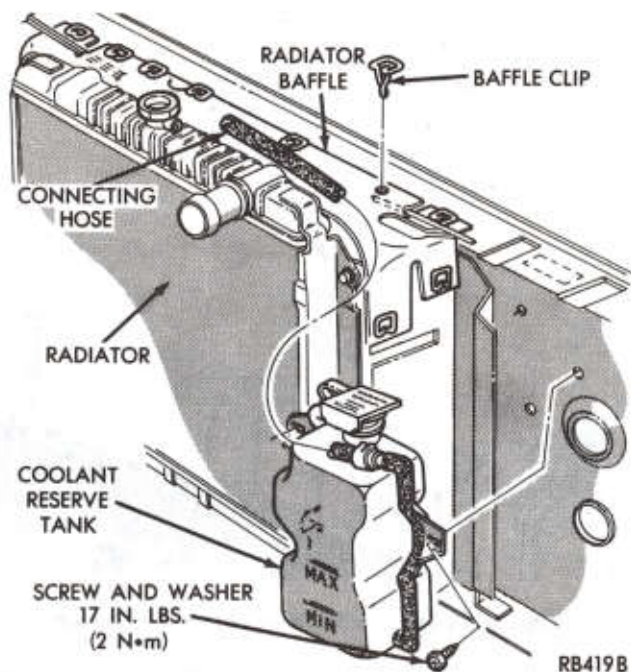


Fig. 8—Coolant Reserve System (Typical)

COOLANT RESERVE SYSTEM (CRS)

This system works in conjunction with the radiator pressure cap to utilize thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides a volume for expansion and contraction, provides a convenient and safe method for checking coolant level and adjusting level at atmospheric pressure without removing the radiator pressure cap. It also provides some reserve coolant to cover minor leaks and evaporation or boiling losses. All vehicles are equipped with this system and take various shapes and forms. Figure 8 shows a typical system in the typical location.

See "Coolant Level Check—Service" and "Deaeration", and "Pressure Cap" sections for operation and service. Vehicles equipped with the electric monitor system use a level sensor in the CRS tank, see Group 8, Electrical, for service.

The tank can become coated with corrosion products and emulsifiable oil. This can be washed out with detergent and water. Rinse well before refilling with 50/50 Glycol and water.

RADIATOR PRESSURE CAP

Radiators are equipped with a pressure cap which releases pressure at some point within a range of 14-18 psi (97-124 kPa).

The system will operate at higher than atmospheric pressure which raises the coolant boiling point allowing increased radiator cooling capacity. The cap contains a pressure relief spring-loaded valve that opens when the pressure reaches the release range of 14 to 18 psi (Fig. 9).

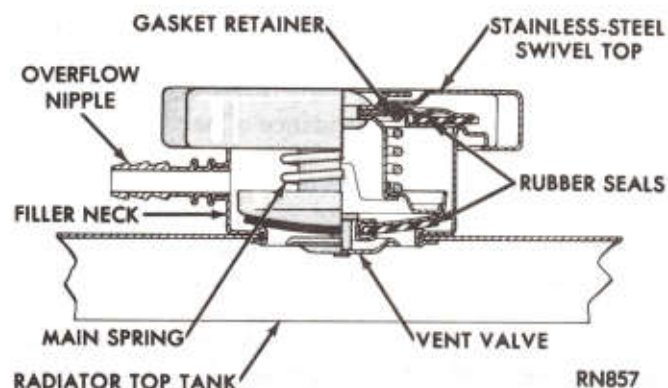


Fig. 9—Radiator Pressure Cap, Filler Neck

There is also a vent valve in the center of the cap that allows a small flow through the cap when below boiling temperature but is closed by an increase in flow as the boiling point is reached.

This valve also opens when coolant is cooling and contracting allowing coolant to return to radiator from coolant reserve system tank by vacuum through connecting hose. If valve is stuck shut the radiator hoses will be observed collapsed on cool down. Clean the vent valve (Fig. 9) to ensure proper sealing when boiling point is reached.

There is also a gasket in the cap to seal to the top of the filler neck so that vacuum can be maintained for drawing coolant back into the radiator from the coolant reserve tank.

Radiator Cap to Filler Neck Seal Pressure Relief Check

The pressure cap upper gasket (seal) pressure relief can be checked by removing the overflow hose at the radiator filler neck nipple (Fig. 10). Attach the Tool

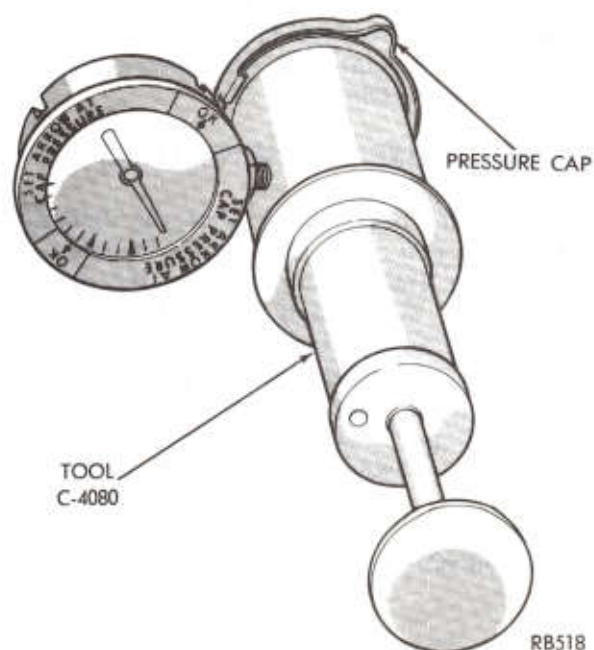


Fig. 10—Pressure Testing Radiator Cap

C-4080 to the filler neck nipple and pump air into the radiator. Pressure cap upper gasket should relieve at 10-18 psi (69-124 kPa) and hold pressure at 8 psi (55 kPa) minimum.

WARNING: THE WARNING WORDS "DO NOT OPEN HOT" ON THE RADIATOR PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE RADIATOR CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT AND/OR UNDER PRESSURE.

There is no need to remove the radiator cap at any time except for the following purposes:

- (1) Check and adjust anti-freeze freeze point.
- (2) Refill system with new anti-freeze.
- (3) Conducting service procedures.
- (4) Checking for vacuum leaks.

CAUTION: If vehicle has been run recently, wait 15 minutes before removing cap, then place a rag over the cap and without pushing down rotate it counter-clockwise to the first stop. Allow fluids to escape through the overflow tube and when the system stops pushing coolant and steam into the CRS tank and pressure drops push down and remove the cap completely. Squeezing the radiator inlet hose with a rag (to check pressure) before and after turning to the first stop is recommended.

PRESSURE TESTING RADIATOR CAPS

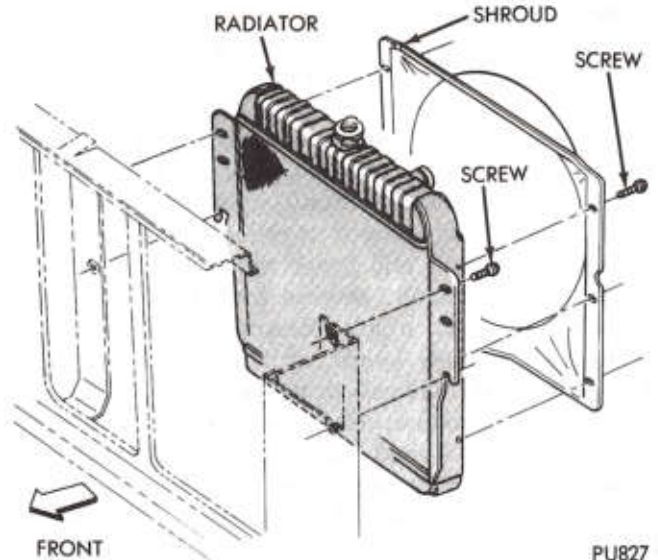
Dip the pressure cap in water, clean any deposits off the vent valve or its seat and apply cap to end of Tool C-4080. Working the plunger, bring the pressure to 15 psi (104 kPa) on the gauge. If the pressure cap fails to hold pressure of at least 14 psi (97 kPa) replace cap. See "CAUTION" below.

If the pressure cap tests properly while positioned on Tool C-4080, but will not hold pressure or vacuum when positioned on the radiator, inspect the radiator filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly, such as dirt, paint, or distortion on the sealing surface.

CAUTION: Tool C-4080 is very sensitive to small air leaks which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to the tool. Turn tool upside down and recheck pressure cap to confirm that cap is bad.

Inspection

Hold the cap in hand, right side up. The vent valve at the bottom of the cap should open. If the rubber gasket has swollen and prevents the valve from opening, replace the cap.



PU827

Fig. 11—Radiator and Shroud Mounting (Typical)

Hold the cleaned cap in hand upside down. If any light can be seen between vent valve and rubber gasket, replace cap. **Do not use a replacement cap that has a spring to hold the vent shut.**

Replacement cap must be of the type designed for coolant reserve system with a completely sealed diaphragm spring, and rubber gasket to seal to filler neck top surface. This design assures coolant return to radiator.

RADIATOR (Fig. 11)

Radiators are downflow, vertical tube type with design features that provide greater strength as well as sufficient heat transfer capabilities to keep engine satisfactorily cooled.

CAUTION: Plastic tanks, while stronger than brass are subject to damage by impact, such as wrenches etc., or by excessive torque or hose clamps.

In case of plastic tank damage, plastic tank and/or O-rings are available for service repair. Tank replacement should be accomplished by qualified personnel with proper equipment.

Radiator Coolant Flow Check

To determine whether coolant is flowing through the cooling system, use the following procedure:

- (1) If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If it is hot, coolant is circulating.
- (2) Drain a small quantity of coolant from the radiator until core tube ends can be seen by looking down through the radiator filler neck. With engine idling at normal operating temperature, if coolant is flowing past the exposed tubes, coolant is circulating.

Removal (Radiator)

(1) Drain cooling system. Move temperature selector for heater to "full on." Without removing pressure cap and with system not under pressure, open drain-cock. When coolant reserve tank is empty, remove pressure cap to hasten completion of draining.

(2) On vehicle with automatic transmission, disconnect oil cooler hose sections at radiator bottom tank.

(3) Remove upper and lower radiator hose clamps and disconnect coolant reserve tank tube from the radiator filler neck nipple. Remove hoses from the radiator. Do not use a screw driver to pry off hoses, because the hose fittings will be damaged.

(4) Remove shroud attaching screws, separate from radiator, position shroud rearward on engine for maximum clearance to radiator (Fig. 11).

(5) Loosen radiator attaching screws at the bottom. Remove radiator attaching screws at the top.

(6) Radiator can now be lifted free from engine compartment. Care should be taken not to damage radiator cooling fins or water tubes during removal. Fan damage should also be avoided.

Installation (Radiator)

(1) Position shroud rearward on engine.

(2) Slide radiator down into position behind radiator support and locate lower radiator mounting holes on the loosened bottom attaching screws. Install upper attaching screws and torque all to 95 in. lbs. (11 N·m).

(3) Install shroud, connect radiator hoses, and transmission oil cooler hose sections. Open heater valve.

(4) Install radiator hose clamps and torque to 35 in. lbs. (4 N·m).

(5) Install transmission clamps and torque to 15 in. lbs. (4 N·m).

(6) Fill cooling system through filler neck with water and anti-freeze. Fill to the top of the filler neck. Also fill the coolant reserve tank to "Max" level. After warm-up, recheck coolant level. See "Refilling System".

RADIATOR HOSES

The hoses are removed using screwdriver, or hex wrench on hose clamp. A torque wrench should be used when tightening hose clamps.

CAUTION: To prevent hose or clamp damage. Tighten to 34 in. lbs. (4 N·m) using a torque wrench. Do not overtighten.

A hardened, cracked, swollen or restricted hose should be replaced. Do not damage radiator inlet and outlet when loosening hoses.

Radiator hoses should be routed without any kinks and indexed and supported (with straps and clips) as

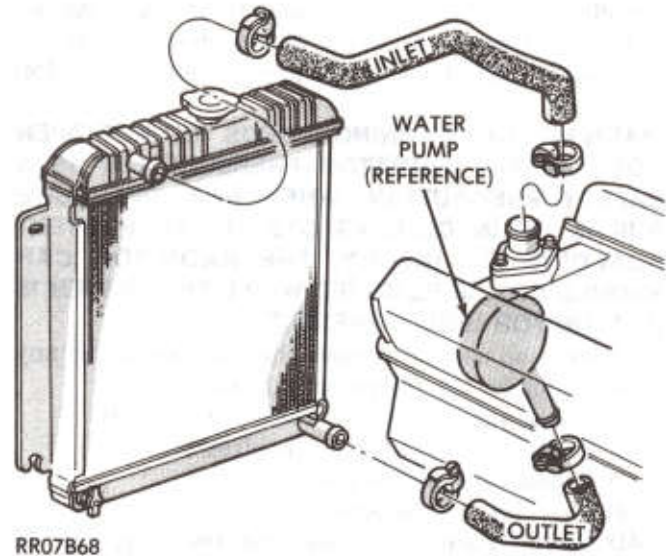


Fig. 12—3.9L, 5.2L, and 5.9L Engine Radiator Hoses

original. The use of molded hose is recommended. (Fig. 12).

The reinforcement spring inside the lower hose is necessary to prevent collapsing of the hose due to water pump suction at medium or high engine speeds. If this spring is misplaced in hose, it should be repositioned. If this spring is deformed, hose and spring must be replaced.

TRANSMISSION OIL COOLER

Automatic transmission oil cooling is accomplished by a cooler located in the bottom tank of the radiator and cooled by engine coolant (Figs. 13 and 14).

In case of a leak in the transmission oil cooler, engine coolant may become mixed with transmission fluid, or transmission fluid may enter the engine cooling system. Both cooling system and transmission should be drained and inspected in the event cooler is leaking.

Test Oil Cooler for Leaks

(1) Disconnect both oil cooler lines at lower tank. (Fig. 14).

(2) Connect a pressure gauge to one cooler connection and a shut off valve to the other. Close the valve.

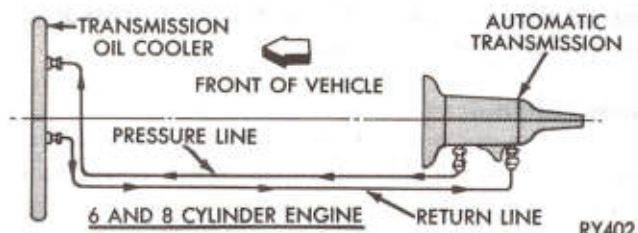


Fig. 13—Oil Flow to Transmission Cooler, Top View

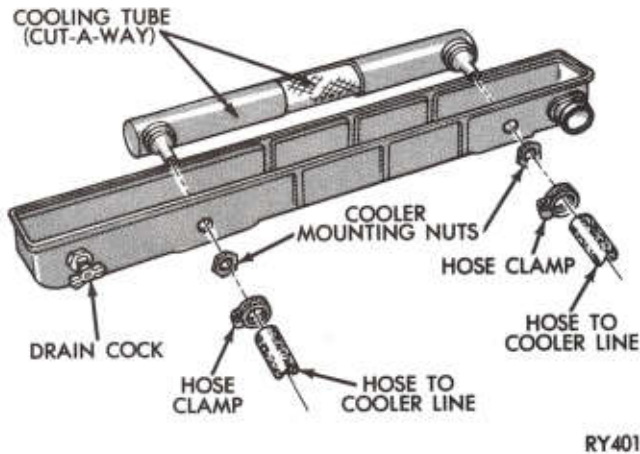


Fig. 14—Transmission Oil Cooler Tube, Radiator Lower Tank

- (3) Connect a source of air pressure to the valve.
- (4) Coat all fittings with soap solution.
- (5) Open the test valve and apply up to 100 psi (689 kPa) air pressure. Soap bubbles will identify any fitting joint leaks. Repair any leaks at fittings.
- (6) Close the valve. Gauge reading will then drop if cooler is leaking.

Replacing Oil Cooler in Bottom Tank

(1) Remove and install radiator as described in Paragraph "Radiator".

(2) Fill cooling system and test for leaks.

If the transmission operates properly after repairing the leak, drain the transmission and torque converter while hot, remove the transmission oil pan and inspect for sludge, rust, dirty or plugged inlet filter. If none of these conditions are found, reconditioning may not be necessary. Reassemble, using transmission fluid of the type labeled DEXRON II.

TRANSMISSION OIL-TO-AIR COOLER

Oil-to-air transmission oil coolers are mounted ahead of the radiator and operate in conjunction with the radiator bottom tank coolers.

On vehicles so equipped oil is routed in series through the radiator bottom tank first, then, through the oil-to-air cooler and returns to the transmission (Fig.15).

FAN

There are no repairs to be made to the fan. If the fan is bent or damaged, it must be replaced.

To check fan for being bent or damaged:

(1) Lay fan on a flat surface with leading edge facing down. Replace fan if there is more than .090 inch (2.0mm) clearance between the blade tip touching the flat surface and the opposite blade. Rocking

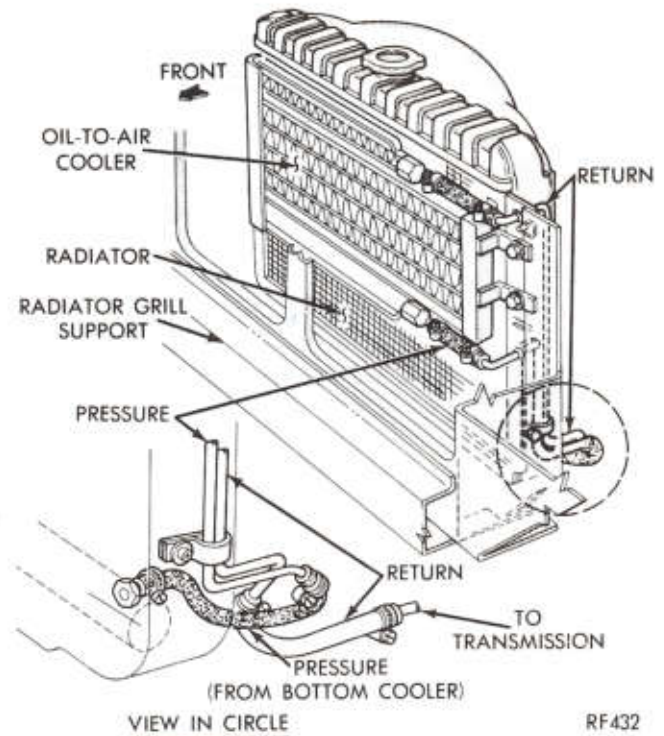


Fig. 15—Transmission Oil-to-Air Cooler

motion of opposite blades should not exceed .090 inch (2.0mm). **NEVER BEND OR STRAIGHTEN FAN.**

(2) Inspect fan assembly and replace if there is evidence of cracks, bends, loose rivets or broken welds.

(3) Also see "WATER PUMP".

CAUTION: Do not stand in line or near fan when accelerating engine speed.

FLUID FAN DRIVE

CAUTION: To prevent silicone fluid from draining into fan drive bearing and ruining the lubricant, do not place drive unit on work bench with rear of shaft pointing downward.

A fluid fan drive should be replaced if there is indication of fluid leak at shaft seal, if noise or roughness is detected when turning unit by hand, if unit cannot be turned by hand, or if blade tip can be moved more than 1/4" (6mm) front to rear.

Removal of Fan and/or Fluid Drive Assembly 3.9L, 5.2L and 5.9L Engines

- (1) Disconnect fusible link in engine compartment and drain coolant partially.
- (2) Remove upper radiator hose from radiator.
- (3) Remove upper half of fan shroud.
- (4) Loosen fan belt.
- (5) Remove fan and fluid drive assembly from water pump.
- (6) Remove fan from fluid drive.



RF439

Fig. 16—Thermal Control Fan Drive

Installation

- (1) Install fan to fluid drive.
- (2) Install fan and fluid drive assembly to water pump.
- (3) Adjust and tighten fan belt to specifications.
- (4) Install upper half of fan shroud.
- (5) Connect upper radiator hose.
- (6) Install clamp and torque to 35 in. lbs. (4 N·m).
- (7) Refill cooling system.

Thermal Control Drive

The Thermal Control Drive (Fig. 16) has a thermostatic spring on the drive face. This thermostat senses temperature from the radiator discharge air and engages the drive for higher fan speed if temperature from the radiator rises above a certain point.

Testing Thermal Control Drive

In case of engine overheating, the thermal control drive can be checked for operation by observing movement of the spring and shaft. To check, lift end of thermostatic coil from slot (Fig. 17) and rotate counterclockwise until a stop is felt. Gap between end of coil and clip on housing should be approximately 1/2 inch (12mm) (Fig. 18). Replace drive unit if shaft does not rotate with coil.

After testing, reinstall end of coil in slot in housing.

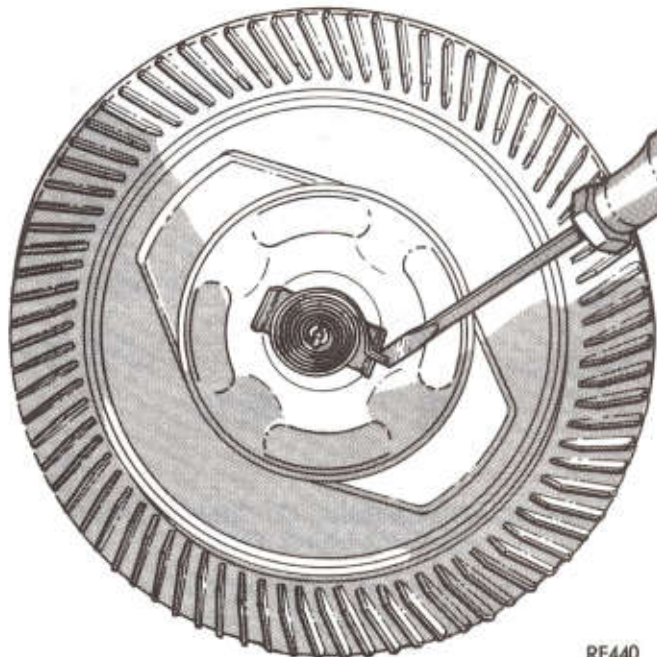
COOLANT CONTROLLED ENGINE VACUUM SWITCH (CCEVS)

Refer to Group 25 for diagnosis and service procedure.

THERMAL IGNITION DISTRIBUTOR CONTROL-TDIC (GRAY 3 PORT)

This valve is used on all 360 4 barrel H.D. cycle engines to provide improved cooling system performance at idle. The valve accomplishes this by advancing the spark timing at coolant temperatures above 225°F at idle ONLY.

Federal usage has the valve in the intake manifold,



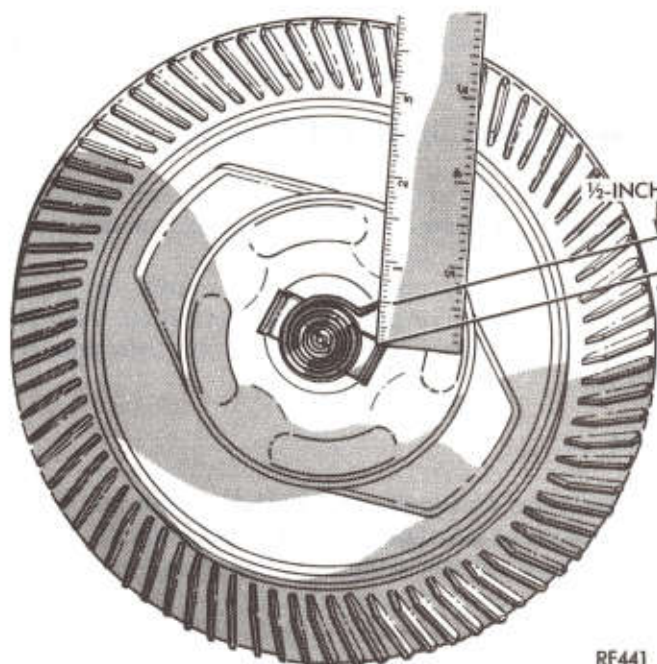
RF440

Fig. 17—Disconnecting End of Thermostatic Coil

but California and Canada have the valve in the upper radiator hose. The non-federal use is only on air conditioning equipped vehicles.

ENGINE IDLE SPEED (ELECTRONIC) CONTROL

For vehicles equipped with 3.9L or 5.2L engine, the engine idle speed is adjusted upward as coolant temperature rises to provide improved cooling system performance. The engine idle speed is increased approximately 150 RPM as coolant temperature reaches 220°F.



RF441

Fig. 18—Checking Spring and Shaft Rotation

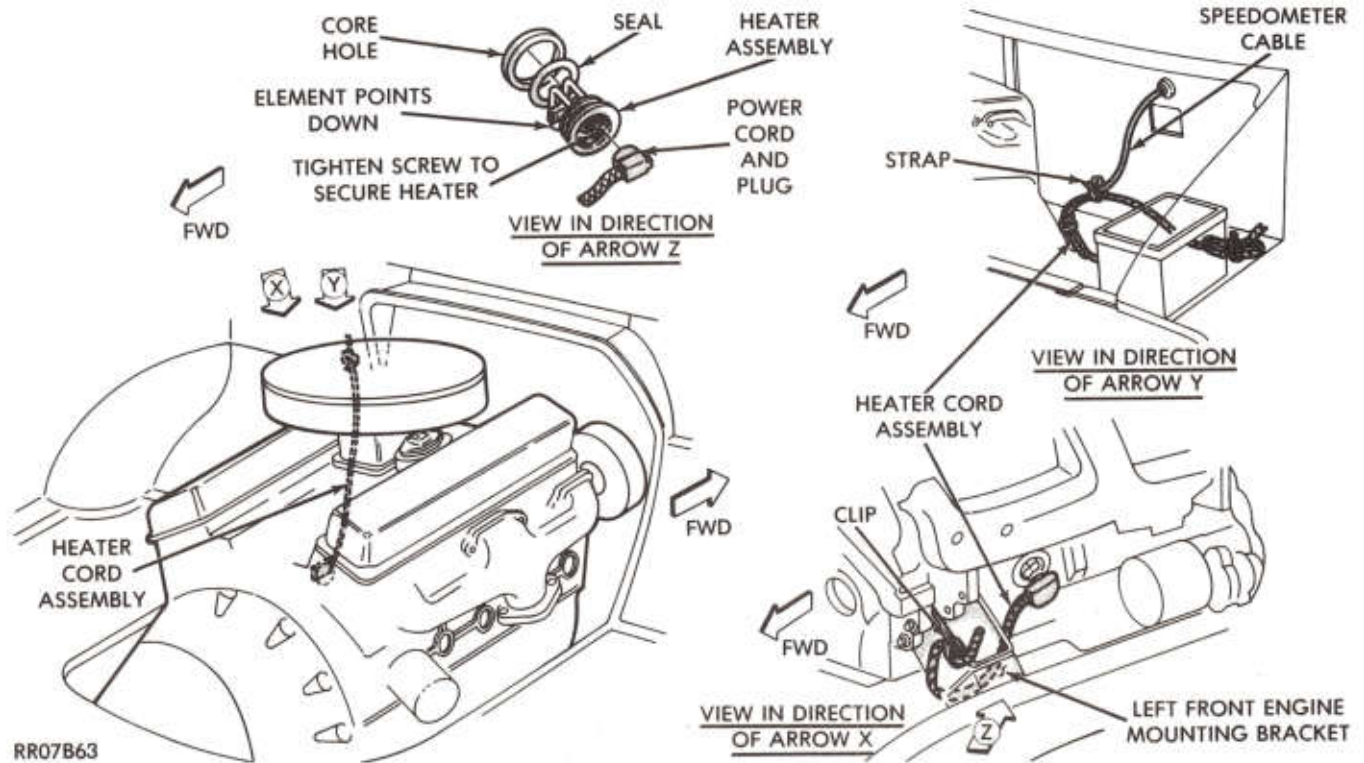


Fig. 19—Engine Block Heater

ENGINE BLOCK HEATER

Description and Operation

On all models an engine block heater is available as an optional accessory. The heater, operated by ordinary house current (110 Volt A.C.) through a power cord and connector behind the radiator grille, provides easier engine starting and faster warm-up when vehicle is operated in areas having extremely low temperatures. The heater is mounted in a core hole (in place of a core hole plug) in the engine block, with the heating element immersed in coolant.

On all engines a heater is mounted on the side of the engine in the core hole behind the exhaust manifold. (Fig. 19).

The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged.

If unit does not operate, trouble can be either the

power cord or the heater element. Test power cord for continuity with a 110-volt voltmeter or 110-volt test light; test heater element continuity with an ohmmeter or 12-volt test light.

Removal

- (1) Drain coolant from radiator and cylinder block.
- (2) Detach power cord plug from heater.
- (3) Loosen screw in center of heater. Remove heater assembly.

Installation

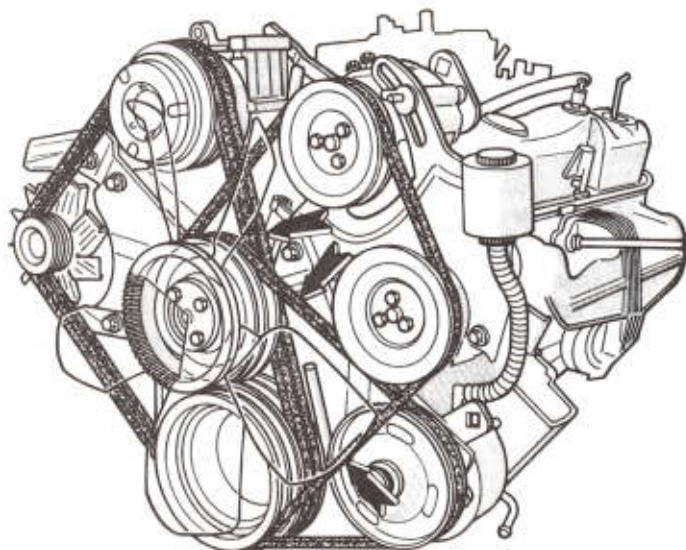
- (1) Thoroughly clean core hole and heater seat.
- (2) Insert heater assembly with element loop positioned **upward**.
- (3) With heater seated, tighten center screw securely to assure a positive seal.
- (4) Fill cooling system with coolant to the proper level, then inspect for leaks.

ACCESSORY DRIVE BELTS (Diagnosis)

Condition	Possible Cause	Correction
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	(a) Belt too loose. (b) Belt excessively glazed or worn.	(a) Adjust belt tension (b) Replace and tighten as specified.
BELT SQUEAL WHEN ACCELERATING ENGINE	(a) Belts too loose. (b) Belts glazed.	(a) Adjust belt tension. (b) Replace belts.
BELT SQUEAK AT IDLE	(a) Belts too loose. (b) Dirt and paint imbedded in belt. (c) Non-uniform belt. (d) Misaligned pulleys. (e) Non-uniform groove or eccentric pulley.	(a) Adjust belt tension. (b) Replace belt. (c) Replace belt. (d) Align accessories (file brackets or use spacers as required). (e) Replace pulley.
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	(a) Broken cord in belt. (c) Belt too loose, or too tight. (c) Misaligned pulleys. (d) Non-uniform groove or eccentric pulley.	(a) Replace belt. (c) Adjust belt tension. (c) Align accessories. (d) Replace pulley.

**SERVICE PROCEDURES
ACCESSORY BELT DRIVES****Proper Belt Tension**

The satisfactory performance of the belt driven accessories depends on the maintenance of the proper belt tension. If the specified tensions are not maintained, belt slippage may cause engine overheating, lack of power steering assist, loss in air conditioning capacity, reduced alternator charging rate, and greatly reduced belt life.



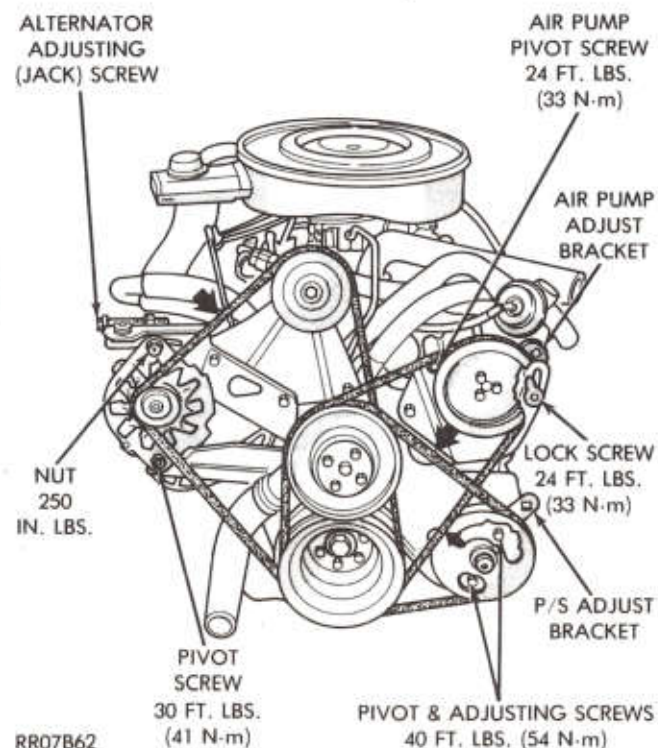
8 CYLINDER ENGINE
WITH AIR CONDITIONING, DUAL AIR PUMPS AND
POWER STEERING PUMP

RR07B61

Belt Deflection and Adjustment

WARNING: BELTS MUST BE CHECKED WITH ENGINE NOT RUNNING.

The belts can be adjusted by measuring the deflection of the belts at the mid-point between two pulleys under a ten-pound push or pull. A small spring scale can be used to establish the ten-pound belt load.



RR07B62

Fig. 20—Accessory Belt Drives, Points of Measuring Deflection (5.9L Engine - Typical)

Fig. 21—3.9 and 5.2L Engine Accessory Drive Belts (Typical)

Belt deflection under a ten-pound push or pull should be between $1/4"$ (6mm) to $5/16"$ (8mm) for all belts at the locations shown in (Figs. 20 and 21). Measure deflection while applying tension to the accessory, then tighten mounting bolts to specified torque. Deflection on a new belt should be between $1/4"$ (6mm) to $1/2"$ (12mm); a belt is considered used after 15 minutes of engine operation and set to between $1/4"$ (6mm) and $5/16"$ (8mm) under a ten-pound load.

To adjust the power steering pump and engine air pump drive belts, use a $1/2"$ drive ratchet, with an extension, inserted into the square hole provided in the pump housing brackets.

To adjust the alternator or air conditioning drive belts, loosen all the mounting bolts on the alternator.

Carefully tighten adjusting screw on alternator to apply tension on the alternator housing and belts.

Borrough's Gauge Method

The belts can be adjusted by measuring the tension of the belts with a borrough's gauge. With Tool C-4162, check the tension of the belt in the middle of the span between the two pulleys (arrows Figs. 20 and 21). Tension should be 80 ft. lbs. (88 N·m), used belt. The correct tension on new belts is 125 ft. lbs. (163 N·m). a belt is to be considered used after only 15 minutes of running time. Belt tension must be read on the gauge while tension is being applied to the accessory and mounting bolts must then be tightened to the specified torque.

SPECIFICATIONS

Engine	Models	Thermostat	Water Pump Impeller	Remarks
318-360	All	195 °F (91 °C)	3.85 Dia. 6 Blades	With or Without Air Conditioning

COOLING SYSTEM CAPACITY

ENGINE *C.U.-Liter	MODEL	DRIVE	RADIATOR Width (Inches)	CAPACITY Quarts-Liter
238-3.9	D150, 250	2-Wheel	26	15.1-14.0
318-5.2	D150, 250, 350	2-Wheel	26	17.0-16.0
360-5.9	D150, 250, 350 and Ramcharger	2-Wheel	26	15.5-14.5
318-5.2	Ramcharger	4-Wheel	26	16.5-15.50
360-5.9	Ramcharger	4-Wheel	26	15.0-14.0
318-5.2	W150, 250, 350	4-Wheel	26	17.0-16.0
360-5.9	W150, 250, 350	4-Wheel	26	15.5-14.5

* Cubic Inch Displacement

** Tall (Radiator)

TIGHTENING REFERENCE

	Inch Pounds	Foot Pounds	Thread Size
Water Pump Bolts	—	30 (41 N-m)	3/8-16
Viscous Fan Drive Attaching Bolts	—	20 (27 N-m)	5/16-18
Fan Attaching Bolts	200 (23 N-m)	—	5/16-18
Thermostat Housing Bolts	200 (23 N-m)	—	3/8-18
Shroud Mounting Nuts	95 (11 N-m)	—	1/4-20
Radiator Mounting Bolts	95 (11 N-m)	—	1/4-20
Drain Cock	150 (17 N-m)	—	—
Drain Cock Handle	22-32 (2-4 N-m)	—	—
Oil Cooler Fittings—			
Lines to Connector (Trans. End)	50 (6 N-m)	—	—
Trans. Cooler Hose Clamps	15 (2 N-m)	—	—
Radiator Hose Clamp	35 (4 N-m)	—	—

N-m—Newton Meters

ELECTRICAL

CONTENTS

	Page		Page
ALTERNATOR SERVICE	8C	RADIO, ANTENNA AND SPEAKERS	8F
BATTERY/STARTER/CHARGING SYSTEM		REAR WINDOW DEFOGGER	8N
DIAGNOSTICS	8A	SEAT BELT WARNING SYSTEM	8M
ELECTRIC LOCKS	8P	SPEED CONTROL	8H
EXTERIOR LAMPS	8L	STARTER SERVICE	8B
HORNS	8G	TURN SIGNALS AND HAZARD	
IGNITION SYSTEM	8D	WARNING FLASHERS	8J
INSTRUMENT PANELS AND GAUGES	8E	WINDSHIELD WIPERS AND WASHERS	8K
POWER MIRRORS	8T	WIRING DIAGRAMS	8W
POWER WINDOWS	8S		

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the breakdown of these designations

is included in the Introduction Section at front of this service manual.

BATTERY/STARTER/CHARGING SYSTEMS DIAGNOSTICS

CONTENTS

	Page		Page
ALTERNATOR TEST PROCEDURES		DIAGNOSTIC INFORMATION	1
ON-VEHICLE TBI ENGINE	15	STARTER TEST PROCEDURES	
BATTERY TEST PROCEDURES		ON-VEHICLE	11
ON-VEHICLE	3		
ALTERNATOR TEST PROCEDURES			
ON-VEHICLE CARBURETED ENGINE	25		

DIAGNOSTIC INFORMATION

INDEX

	Page		Page
General Information	1	Introduction to Starting and Charging	
Introduction to Starting and Charging		System Diagnostics TBI Engine	1
System Diagnostics Carbureted Engine	2		

GENERAL INFORMATION

This Group will cover only the diagnostic procedures for the battery, starting, and charging systems. Service information for battery and starter can be found in Group 8B. Service information for alternator can be found in Group 8C.

Introduction to Starting and Charging System Diagnostics TBI Engine

The Battery, Starting, and Charging Systems operate in conjunction with one another, and therefore, must be thoroughly tested as a complete system. In order for the vehicle to start and charge properly, it must have a battery that will perform to specifications. The starter motor, alternator, wiring, and elec-

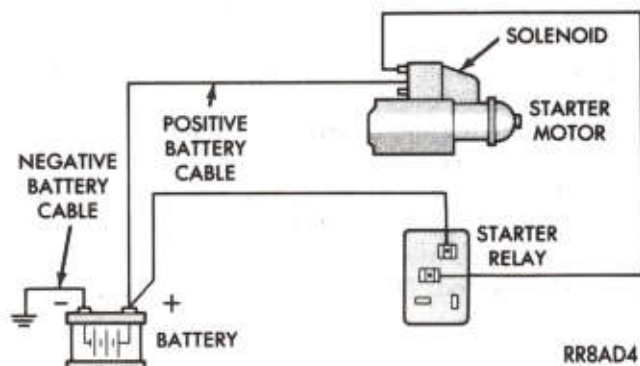


Fig. 1—Starting System Components

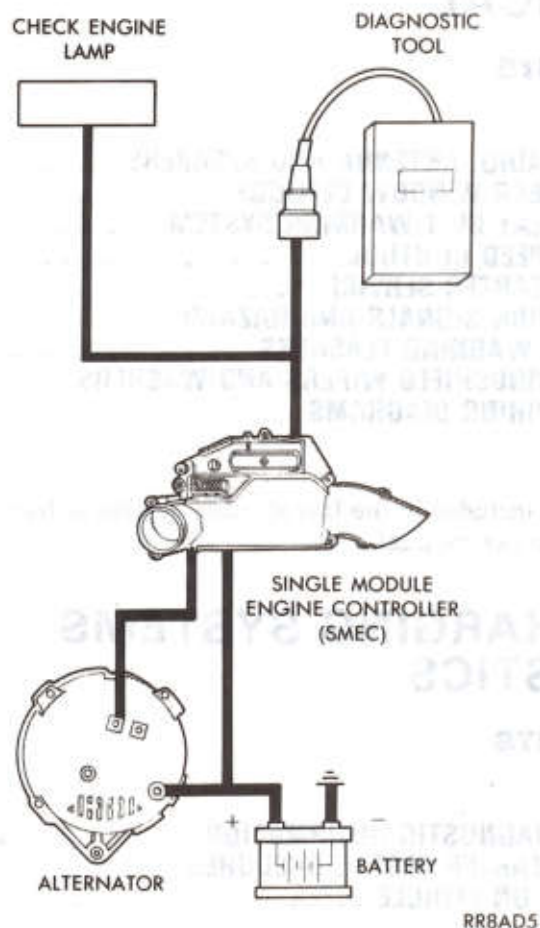


Fig. 2—Charging System Components TBI Engine

tronics also must perform within specifications. Group 8A will cover Starting (Fig. 1) and Charging (Fig. 2) System diagnostic procedures from the most basic conventional methods to "On Board Diagnostics" (OBD) built into the vehicle's electronics. The need for conventional testing equipment has not been eliminated by the introduction of OBD. Frequent use of an amp meter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12 volt test light will be required.

All vehicles with TBI engines are equipped with OBD. All OBD sensing systems are monitored by the Single Module Engine Controller (SMEC). The SMEC will store in electronic memory any detectable failure within the monitored circuits. The SMEC will retain this information for a period of fifty (50) engine starts, then erase the memory if the failure does not reoccur during that period. The SMEC will translate a moni-

tored failure in the form of a numerical Fault Code when a readout command is given. A command can be made by cycling the ignition switch ON-OFF-ON-OFF-ON (without starting the engine) within five (5) seconds. The CHECK ENGINE lamp on the instrument cluster will flash in predetermined sequences to indicate fault codes. However, the CHECK ENGINE lamp cannot express fault codes for all failures or initiate test modes for monitored circuits. Numerical fault codes are easier to obtain and more complete with the use of a Diagnostic Tool plugged into the diagnostic connector, located in the engine compartment (Fig. 2). See Group 14, "Fuel Injection" for additional information.

Introduction to Starting and Charging System Diagnostics Carbureted Engine

The battery, starting, and charging systems operate in conjunction with one another, and therefore, must be thoroughly tested as a complete system. In order for the vehicle to start and charge properly, it must have a battery that will perform to specifications. The starter motor, alternator, voltage regulator, and wiring also must perform within specifications. Group 8A will cover battery (Fig. 1), starting (Fig. 1), and charging systems (Fig. 3) diagnostic procedures only. Service procedures for battery and starter motors can be found in Group 8B. Service procedures for alternators can be found in Group 8C.

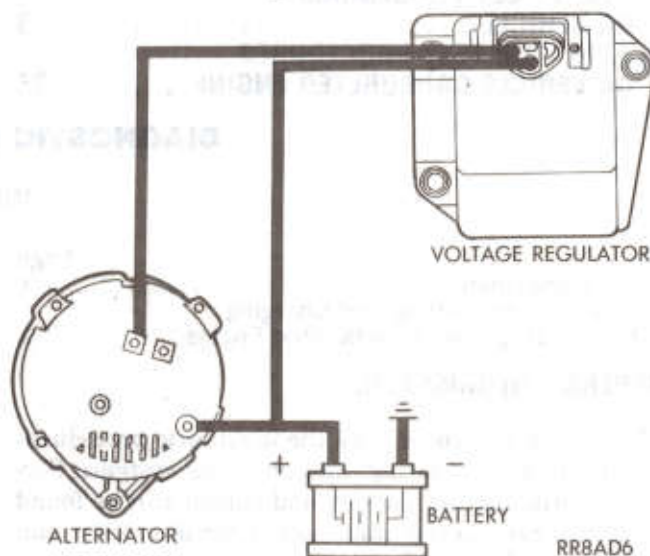


Fig. 3—Charging System Components Carbureted Engine

BATTERY TEST PROCEDURES ON-VEHICLE

INDEX

	Page		Page
Battery Charging Rate and Time Table Chart 5 ..	6	Size of Battery	7
Battery Diagnosis with Test Indicator	9	State of Charge	7
Battery Diagnosis without Test Indicator	10	Temperature	7
Battery Electrical Drain	4	Built-in Test Indicator (Hydrometer)	3
Battery Charge Percent—Chart 4	6	Built-in Test Indicator (State of Charge)	3
Battery Electrical Drain Leakage Test	4	Charge Rate—Chart 6	8
Battery Recharging Procedures	6	Load Test	5
Charging Time Required	7	Load Test—Chart 3	5
Charging a Completely Discharged		Load Test Rate—Chart 2	5
Battery (Off Vehicle)	7	Open Circuit Voltage Test	6
Charger Capacity	7	State of Charge (SOC)—Chart 1	4

POSSIBLE CAUSES OF ABNORMAL BATTERY DISCHARGING

Discharged Batteries are often not the fault of the battery but caused by certain conditions in the vehicle. Foremost among these are:

(1) **Charging System Output Low** due to loose alternator drive belt, faulty alternator or voltage regulator or electrical system short circuits.

(2) **Corroded Battery Posts or Connectors.** Corrosion film that forms on posts and connectors can prevent good electrical contact with battery, even when connections are tight.

(3) **Prolonged Storage, with Battery Connected.** Vehicles normally have a small, continuous electrical Drain (with ignition switch turned off) on battery of as much as 20-30 milliamperes. All vehicles are equipped with a "Ignition Off Draw (IOD) connector" located rearward of the battery, see "Wiring Diagrams" for additional information. Vehicles equipped with options using electronic memories may have electrical drain greater than 20-30 milliamperes, in these cases the IOD connector should be disconnected when the vehicle is not used for extended periods.

(4) Vehicle electrical load in excess of alternator output due to equipment or accessories installed after delivery.

(5) Vehicles accessories left on for a period of time while vehicle is not running.

(6) Slow average driving speeds.

(7) Loose battery terminal connections.

(8) Prolonged idle periods and/or extremely slow driving speeds with maximum electrical loads.

(9) Mechanical conditions in the electrical system that drains battery such as shorted or pinched wires, defective switches, relays, etc.

CAUTION: If a vehicle is being repaired over an extended period, the battery should be disconnected, except when battery use is required by the repair.

BUILT-IN TEST INDICATOR (HYDROMETER)

The test indicator is a **built-in hydrometer** on top of battery case and provides visual information for battery testing (Fig. 4). The test indicator is to be used with accepted diagnostic procedures only. It should not be used to determine if battery is good or bad.

It is important when observing test indicator that battery be relatively level and have a clean top to see correct indications. A light may be required to view indicator.

WARNING: DO NOT USE OPEN FLAME.

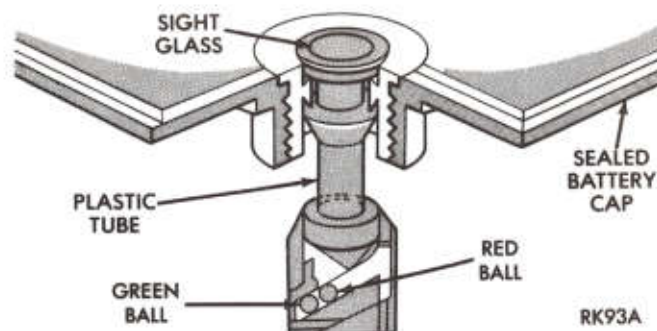


Fig. 4—Built-in Test Indicator

BUILT-IN TEST INDICATOR (STATE OF CHARGE)

One of four conditions can be observed from a maintenance free battery indicator as follows:

(1) **Green dot (Fig. 5 State of Charge—Chart 1)**

Any green appearance is interpreted as a "green dot" above 75% state of charge, and battery is adequately charged for testing. On rare occasions following prolonged cranking, green dot may still be visible. Should this occur, charge battery as described in "Battery Charging Procedures."

(2) **A Dark or black dot (Fig. 5 State of Charge—Chart 1)**

A dark or black dot indication is a result of

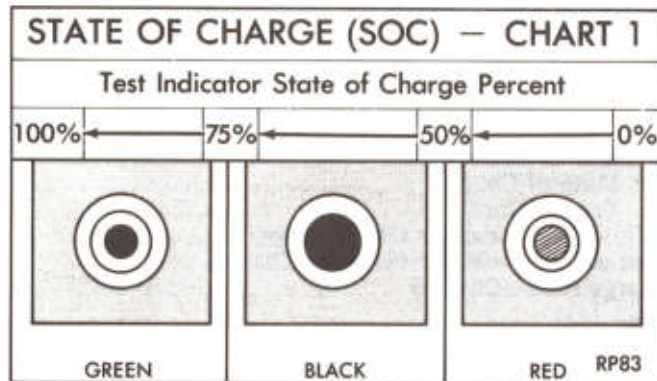


Fig. 5—Test Indicator (Built-in Hydrometer)

battery being partially discharged below a 75% state of charge level. Battery should be checked and charged as described in "Battery Charging Procedures" until Green Dot is visible prior to performing any other Tests.

(3) **Red Dot (Fig. 5 State of Charge—Chart 1)**

A red dot indicates a discharge battery below a 50% state of charge level. Battery should be checked and charged as described in "Battery Charging Procedures" until green dot is visible prior to performing any other Tests.

WARNING: IF BATTERY REMAINS IN THIS CONDITION FOR ANY LENGTH OF TIME PERMANENT DAMAGE MAY OCCUR.

(4) **Bright or Yellow Dot**

WARNING: ON RARE OCCASIONS, TEST INDICATOR MAY TURN LIGHT YELLOW OR BRIGHT IN COLOR THIS INDICATES LOW ELECTROLYTE LEVEL IN THIS CASE, VEHICLES CHARGING SYSTEM SHOULD BE THOROUGHLY CHECKED FOR BATTERY OVERCHARGED CONDITION AS COVERED IN APPLICABLE SECTION OF THIS SERVICE MANUAL. ALTHOUGH BATTERY MAY TEMPORARILY APPEAR SERVICABLE REPLACE BATTERY, DO NOT ATTEMPT TO CHARGE, TEST, OR JUMP START VEHICLE.

BATTERY ELECTRICAL DRAIN

Vehicle batteries have a normal small continuous drain with ignition switch turned off as much as 20-30 milliamperes due to digital clocks and solid state devices. In addition, there may be other conditions in vehicle's electrical system that causes excessive electrical drain on a battery such as shorted or pinched wires misadjusted switches faulty components and other conditions that cause battery to discharge at a very fast rate even when all accessories are turned off. To check for electrical drain refer to "Battery Electrical Drain Leakage Test" in this section.

BATTERY ELECTRICAL DRAIN LEAKAGE TEST

(1) To check for leakage, turn off all accessories in vehicle, remove ignition key, turn off all lights, shut glove box, and doors. If there is an underhood or cargo lamp verify lamp is off when hood or door is closed, then remove bulbs. Now check for leaks by the following method:

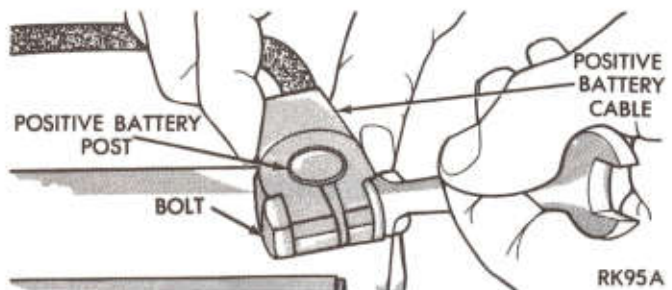


Fig. 6—Disconnecting Positive Battery Cable

(2) At battery, disconnect cable that connects to vehicle's starter (positive (+) cable) (Fig. 6).

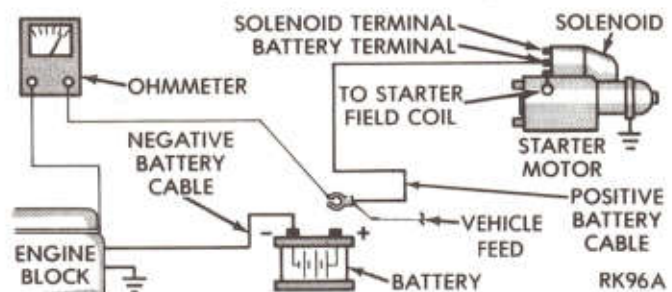


Fig. 7—Resistance Leak Test

(3) With an ohmmeter measure resistance between the disconnected positive cable end and vehicle's chassis or engine block (Fig. 7). A reading of over 200 ohms indicates no electrical drain.

(4) A reading under 200 ohms indicates a drain which must be corrected.

(5) Reconnect positive battery cable (Fig. 7). Do not tighten connection.

(6) Complete a visual inspection for obvious drains (light on, loose wiring connections, etc.) If vehicle is equipped with illuminated entry system, allow it to time out.

(7) Correct drain by replacing component(s) and correct wiring shorts as specified by applicable section of the service manuals.

(8) No obvious drains found:

(a) Remove fuses one at a time to determine source fuse (wiring location) of drain.

(b) Check resistance (as specified above) after removing fuse.

(c) Return fuse to proper location in fuse panel.

(d) Repeat until source fuse (wiring location) is determined.

(9) Source fuse(s) (wiring location) found:

(a) Determine which component or wire is producing the excessive drain relative to the source fuse.

(b) Refer to applicable component diagnostic procedures and wiring diagrams as specified in service manuals to eliminate electrical drain.

(10) Connect battery cable.

(11) Tighten cable clamp nut securely.

LOAD TEST

(1) Observe indicator for presence of green dot (Fig. 5). If not visible, charge battery prior to testing.

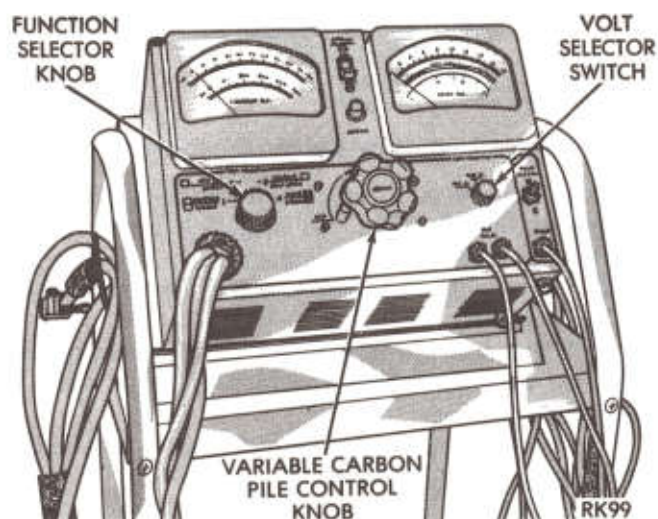


Fig. 8—Volt-Ammeter Tester

(2) Observing polarity, connect a voltmeter and a battery load tester across battery terminals (Fig. 8).

(3) Apply **300 amp** load for 15 seconds to remove surface charge from battery (Fig. 9). Remove load.

LOAD TEST RATE—CHART 2		
Load Test (Amps)	Cranking Rating @ 0°F	Reserve Capacity
200 Amp	400 Amp	100 Minutes
250 Amp	500 Amp	110 Minutes
315 Amp	625 Amp	120 Minutes

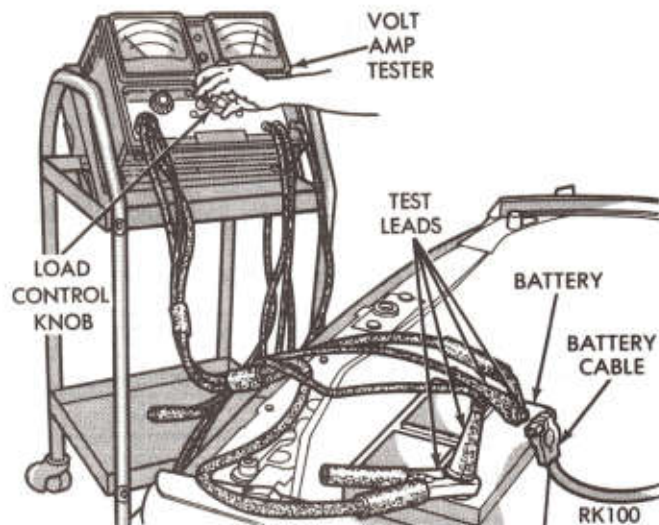


Fig. 9—Battery Load Test

(4) Wait 15 seconds to let battery recover and apply load equal to 1/2 of cold crank ampere rating of battery. See Load Test Rate—Chart 2.

LOAD TEST—CHART 3		
Minimum Voltage	Temperature	
	F°	C°
9.6	70 and above	21 and above
9.5	60	16
9.4	50	10
9.3	40	4
9.1	30	−1
8.9	20	−7
8.7	10	−12
8.5	0	−18

(5) Read voltage after 15 seconds with specified load applied, then disconnect load.

(6) If voltage does not drop below minimum listed in Load Test—Chart 3, battery is good and should be returned to service. (Battery temperature must be estimated by temperature battery has been exposed to for preceding few hours.)

(7) If battery passes load test, its in good condition. No further tests are necessary. If it fails load test, it should be replaced.

OPEN CIRCUIT VOLTAGE

Open circuit or no load voltage is good measure of battery state of charge after battery has stabilized. This takes a couple of minutes of rest at open circuit after load test has been completed.

(1) Remove both battery cables and place a voltmeter between battery posts.

(2) This voltage reading shows battery charge thus:

BATTERY CHARGE PERCENT—CHART 4	
Open Circuit Volts	Percent Charge
11.7 volts or less	0%
12.0	25%
12.2	50%
12.4	75%
12.6 or more	100%

Because change of voltage with charge is small, most battery testers use special voltmeters with scales expanded to better show percent charge. If charge is 75% (12.4 volts) or more, battery is considered charged. If it failed load test with this 75% charge or more, it should be replaced.

BATTERY RECHARGING PROCEDURES

WARNING: WHEN BATTERIES ARE BEING CHARGED AN EXPLOSIVE GAS MIXTURE FORMS BENEATH COVERS OF EACH CELL. DO NOT SMOKE NEAR BATTERIES ON CHARGE OR WHICH HAVE RECENTLY BEEN CHARGED. DO NOT BREAK LIVE CIRCUITS AT TERMINALS OF BATTERIES ON CHARGE. CHARGER SHOULD BE TURNED OFF OR UNPLUGGED BEFORE DISCONNECTING. A SPARK WILL OCCUR WHERE LIVE CIRCUIT IS BROKEN. KEEP ALL OPEN FLAMES AWAY FROM BATTERY. DO NOT CHARGE FROZEN BATTERIES.

Battery charging equipment varies from one manufacturer to the other. Therefore, follow specific charger manufacturer's instructions of proper setup and safety precautions.

When it is necessary to charge a sealed battery, the following safety precautions must be followed.

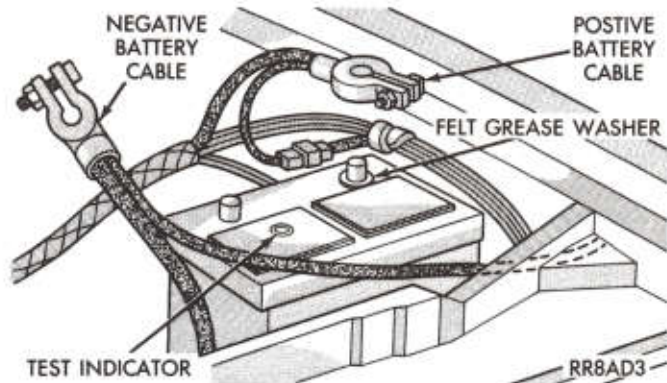


Fig. 10—Battery Cables Disconnected

(1) If battery is to remain in vehicle, disconnect cables at battery (Fig. 10), negative cable first to prevent electrical system damage.

(2) Thoroughly clean battery. Refer to "battery visual inspection".

(3) If green dot is visible and vehicle has not been cranked recently for an extended period of time, do not charge battery.

(4) Do not charge battery if hydrometer (test indicator) is clear or light yellow. Replace battery.

(5) If battery feels hot 125°F (52°C), or if violent gassing or spewing of electrolyte through vent hole occurs, discontinue charging until excessive gassing stops then continue charging at a reduced charging rate.

CAUTION: Charge battery only until green dot appears. Do not overcharge.

BATTERY CHARGING RATE AND TIME TABLE—CHART 5							
Battery Size			400, 500 and 625 Amp				
Charging Rate in Amperes			5	10	20	30	
Open Circuit Voltage		Test Indicator	Charging Time in Hours				
12.25	12.39	Dark or Black	6	3	1.5	1	
12.10	12.24	Red	8	4	2	1.5	
11.95	12.09	Red	12	6	3	2	
10.00	11.95	Red	14	7	3.5	2.5	
10 volts or less		Red	PROCEED TO CHARGING A COMPLETELY DISCHARGED BATTERY.				

Slight tipping or shaking of battery may be necessary to make green ball (Fig. 5) appear.

(6) Make sure all charger connections are clean and tight.

(7) For best results, batteries should be charged while electrolyte and plates are at room temperature. A battery that is extremely cold may not accept current for several hours after starting charger.

(8) Charge battery until green dot appears. **See Battery Charging Rate and Time Table—Chart 5.** Battery should be checked every half-hour while charging. Tipping or shaking battery may be necessary to make green dot appear.

(9) After charging, battery should be tested as outlined in "Load Test" procedure.

WARNING: SOME CHARGERS FEATURE VOLTAGE SENSITIVE SWITCHES. A COMPLETELY DISCHARGED BATTERY MAY NOT HAVE ENOUGH VOLTAGE TO ACTIVATE THIS CIRCUITRY ENOUGH THOUGH LEADS ARE CONNECTED PROPERLY, MAKING IT APPEAR THAT BATTERY WILL NOT ACCEPT CHARGING CURRENT.

Follow charger manufacturers' instructions telling how to by-pass or override circuitry so that charger will turn on and charge a low-voltage battery.

Charging Time Required

The time required to charge a battery will vary depending upon the following factors:

(1) **Size of Battery**—A completely discharged large heavy-duty battery requires more than twice the recharging as a completely discharged small passenger car battery.

(2) **Temperature**—A longer time will be needed for charging any battery at 0°F (-18°C) than at 80°F (27°C). When a fast charger is connected to a cold battery, current accepted by battery will be very low at first. Then, in time, the battery will accept a higher rate as battery warms.

(3) **Charger Capacity**—A charger which can supply only five amperes will require a much longer period of charging than a charger that can supply 30 amperes or more.

(4) **State-Of-Charge**—A completely discharged battery requires more than twice as much charge as a one-half charged battery. Because electrolyte is nearly pure water and a poor conductor in a completely discharged battery, current accepted by battery is very low at first. Later, as charging current causes electrolyte acid content to increase, charging current will likewise increase.

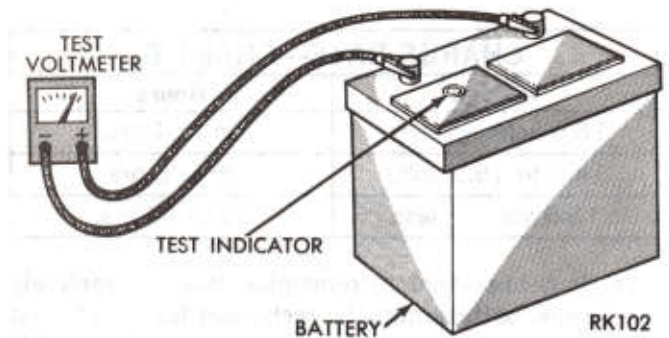


Fig. 11—Voltmeter (Accurate to 1/10 Volt) Tester Connected

Charging a Completely Discharged Battery (Off The Vehicle)

The following procedure should be used to recharge a completely discharged battery. Unless procedure is properly followed, a good battery may be needlessly replaced.

(1) Measure voltage at battery terminals with a voltmeter, accurately to 1/10 volt. (Fig. 11). If below 10 volts, then charge current will be low and it could take some time before it accepts a current in excess of a few milliamperes. Such low current may not be detectable on ammeters built into many chargers.

(2) Set battery charger on high setting.

(3) Connect charger leads with correct polarity. Some chargers feature polarity protection circuitry which prevents charging unless charger leads are connected to battery terminals correctly. **A completely discharged battery may not have enough voltage to activate this circuitry, even though leads are connected properly, making it appear that battery will not accept charging current.** Therefore, follow specific charger manufacturer's instructions telling how to by-pass or override circuitry so that charger will turn on and charge a low-voltage battery.

(4) Battery chargers vary in the amount of voltage and current they provide. For time required for battery to accept measurable charger current at various voltages refer to **Charge Rate—Chart 6.** **If charge current is still not measurable at end of charging times, the battery should be replaced. If charge current is measurable during charging time, the battery is considered to be good and charging should be completed in the normal manner.**

CHARGE RATE—CHART 6	
Voltage	Hours
16.0 volts or more	up to 4 hrs.
14.0 to 15.9 volts	up to 8 hrs.
13.9 volts or less	up to 16 hrs.

(5) It is important to remember that a completely discharged battery must be recharged for a sufficient number of ampere hours (ah) to restore it to a usable state. Using reserve capacity rating (rc) of battery as the number of ampere hours of charge will usually bring the green dot into view. For example, if battery

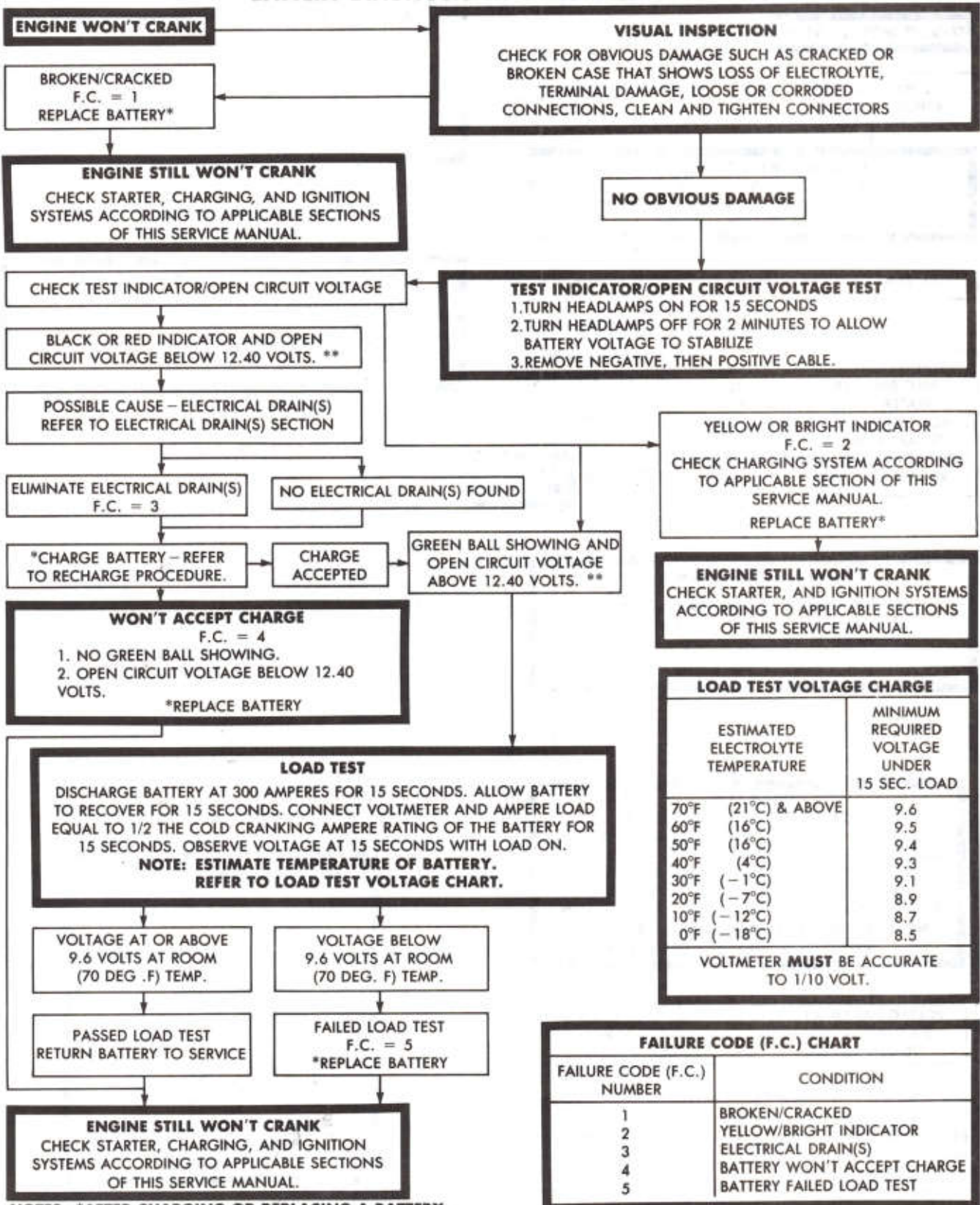
is rated at 75 rc minutes, it would be completely recharged as follows:

10 ampere charge $\times$ 7-1/2 hours = 75 ah or 25 ampere charge $\times$ 3 hours = 75ah, etc.

(6) It is recommended that any battery recharged by this procedure be Load Tested to establish serviceability.

WARNING: WHEN CHARGING ON "HIGH" BOOST SETTING BATTERY MUST BE CHECKED EVERY 30 MINUTES TO INSURE THAT VIOLENT GASSING OR SPEWING OF ELECTROLYTE THROUGH VENT HOLES DOES NOT OCCUR. IF VIOLENT GASSING RESULTS, CHARGE RATE MUST BE REDUCED TO A LEVEL WHERE EXCESSIVE GASSING STOPS.

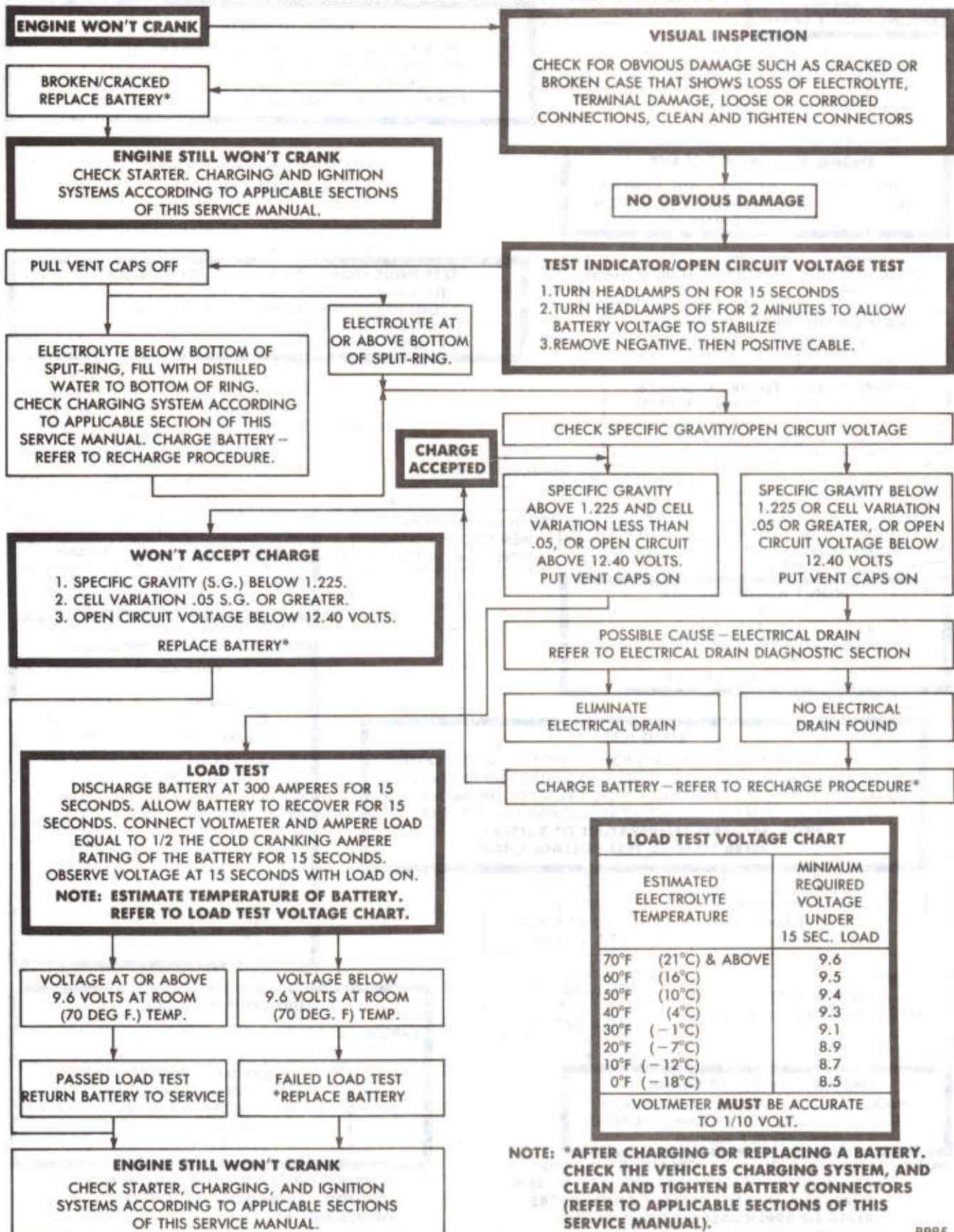
BATTERY DIAGNOSIS WITH TEST INDICATOR



NOTES: *AFTER CHARGING OR REPLACING A BATTERY, CHECK THE VEHICLE'S CHARGING SYSTEM, AND CLEAN AND TIGHTEN BATTERY CONNECTORS (REFER TO APPLICABLE SECTIONS OF THIS SERVICE MANUAL).

** CHECKING OPEN CIRCUIT VOLTAGE WILL MONITOR "GREEN BALL" INDICATION FOR ALL 6 CELLS.

BATTERY DIAGNOSIS WITHOUT TEST INDICATOR



STARTER TEST PROCEDURES ON VEHICLE

INDEX

	Page		Page
Circuit Resistance Chart	12	Starter Solenoid Test	12
Control Circuit	12	Starter Motor Diagnosis	14
Bench Testing Starter Solenoid	13	Supply Circuit	11
Ignition Switch Test	13	Amperage Draw Test	11
Starter Relay Test	12	Resistance Test	11

SUPPLY CIRCUIT

Supply circuit consists of battery, battery cables, clamps, and connectors (see Diagnostic Information section). In checking this circuit always begin with a visual inspection of battery post and cable clamps.

Before starting any tests make sure vehicle has a fully charged battery. Tests and procedures on how to check for a fully charged battery are shown in "Battery" section of this manual.

If connections and battery are good, proceed as follows in checking supply circuit.

Amperage Draw Test (with Starter Tester)

Engine should be up to operating temperature. Extremely heavy oil or a tight engine will increase starter amperage draw.

(1) Connect a reliable Battery-Starter Tester per instructions of its manufacturer (Fig. 1).

(2) Turn Battery—Starter Tester, Control Knob to "Off" position (Fig. 1).

(3) Turn voltmeter Selector Knob to 16 volt position (Fig. 1).

(4) Turn Battery-Starter Function Selector to Starter System Test (0-500 amp scale Fig. 1).

(5) Connect heavy Positive ammeter lead (Red) to Positive battery terminal. Connect heavy Negative ammeter lead (Black) to Negative battery terminal (Fig. 2).

(6) Connect Positive voltmeter lead (Red) to Positive battery terminal. Connect Negative voltmeter lead (Black) to Negative battery terminal (Fig. 2).

(7) Connect a remote starter jumper per instructions of its manufacturer (Fig. 2).

CAUTION: Do not crank engine excessively or starter may overheat and damage will occur.

(8) Disconnect coil wire from distributor cap center tower and secure a good ground to prevent engine from starting.

(9) Crank engine with remote control starter switch and observe Exact reading on Voltmeter.

(10) Stop cranking engine.

(11) Without cranking engine, turn tester Control Knob clockwise until voltmeter reads Exactly the same as when engine was being cranked with remote control starter switch. Ammeter now indicates starter amperage draw.

(12) Refer to Group 8B, "Specifications" for amper-

age draw limits.

(13) If amperage draw is below specified value proceed to supply circuit resistance test.

(14) If amperage draw is above specified value a faulty starter motor is suspected and starter must be removed from vehicle and bench tested.

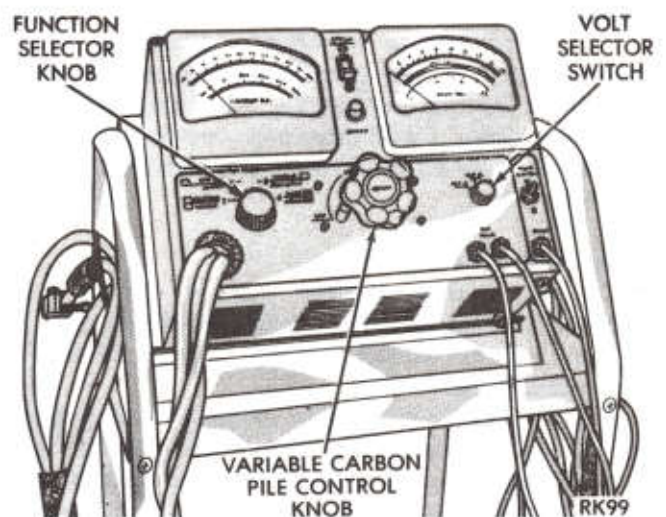


Fig. 1—Volt-Ammeter Tester

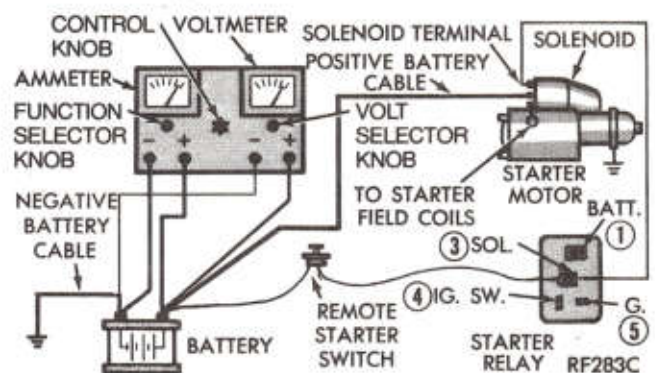


Fig. 2—Amperage Draw Test

Resistance Test

High resistance in the supply circuit wiring or connections will cause the starter motor to crank the engine at a slower rate than normal. These connections can be tested for high resistance with the use of

a reliable voltmeter which will indicate tenths of a volt. Also, all tests are made without separating or disconnecting any connection. Voltmeter leads are to be connected across each of connections shown in Circuit Resistance Chart. While the engine is being cranked, note reading of voltmeter. If any of the readings are higher than the specified limits there is high resistance in that connection and it must be cleaned or repaired. After doing so, repeat test at connection.

CONTROL CIRCUIT

Starter control circuit consists of starter solenoid, starter relay, ignition switch, safety neutral switch (automatic transmission), and all their wiring and connections.

Testing procedures for these components are as follows and should be followed in order as described.

CAUTION: Before performing any test disconnect coil wire from distributor cap center tower and secure to a good ground to prevent engine from starting.

Starter Solenoid Test

Connect a heavy jumper wire on starter relay between battery (1) and solenoid (3) terminals (Fig. 3). If engine cranks starter solenoid is good. Proceed to starter relay test.

If engine does not crank or solenoid chatters check wiring and connectors from relay to starter for loose or corroded connections, particularly at starter terminals. Repeat test and if engine still fails to crank properly trouble is within starter and it must be removed for repairs.

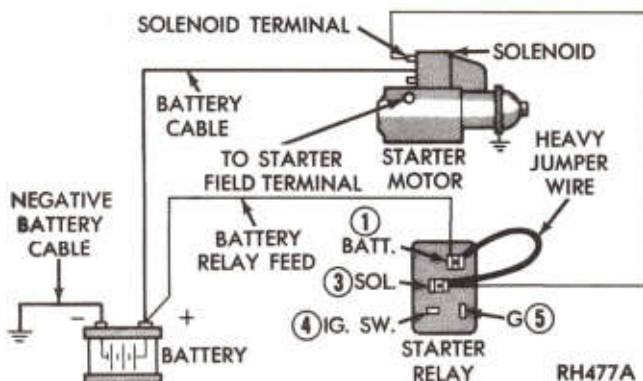


Fig. 3—Starter Solenoid Test (Typical)

Starter Relay Test

(After starter solenoid test)

(1) Position automatic transaxle gear selector in neutral or park position.

(2) Position manual transaxle gear selector in neutral.

(3) Set park brake.

(4) Do not remove relay connector.

(5) Check for battery voltage between starter relay battery (1) terminal and ground with a test lamp.

(6) Connect a jumper wire on the starter relay between battery and (1) ignition (4) terminals (Fig. 4). If engine cranks starter relay is good.

(7) If engine does not crank connect a second jumper wire to starter relay between ground terminal and to a good ground (5) (Fig. 5). Repeat test and if engine cranks, starter relay is good.

Check transmission linkage adjustment or safety neutral switch. If engine does not crank, starter relay is defective and must be replaced.

CIRCUIT RESISTANCE CHART

Connection	Voltmeter Lead Connection		Voltmeter Reading
	Positive	Negative	
Positive post on battery to battery cable clamp	Positive battery post	Battery cable clamp	0 volts
Positive post on Battery to starter battery terminal	Positive battery post	Battery terminal on starter	0.2 volts
Positive post on battery to solenoid lead to field coils	Positive battery post	Solenoid lead to field coils	0.3 volts
Negative post of battery to cable clamp	Negative battery post	Battery cable clamp	0 volts
Negative post on battery to engine block	Negative battery post	Battery cable connector on engine block	0.2 volts
Starter housing to ground	Starter housing	Negative battery post	0.2 volts

Ignition Switch Test

After testing starter solenoid and relay and they check out okay, trouble is probably with ignition switch or its wiring.

Check all wiring for opens and shorts and connections for being loose or corroded, see Group 8W, Wiring Diagrams.

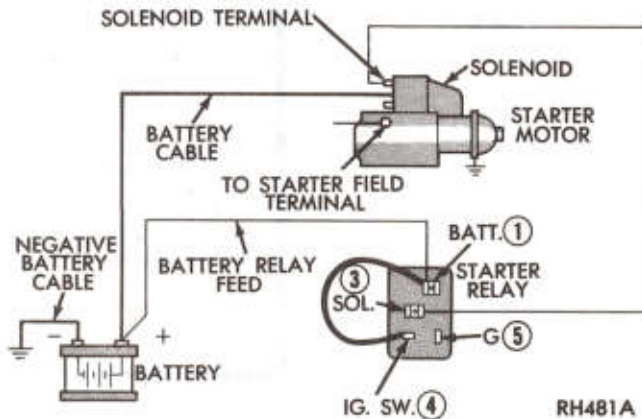


Fig. 4—Relay Test with One Jumper Wire (Typical)

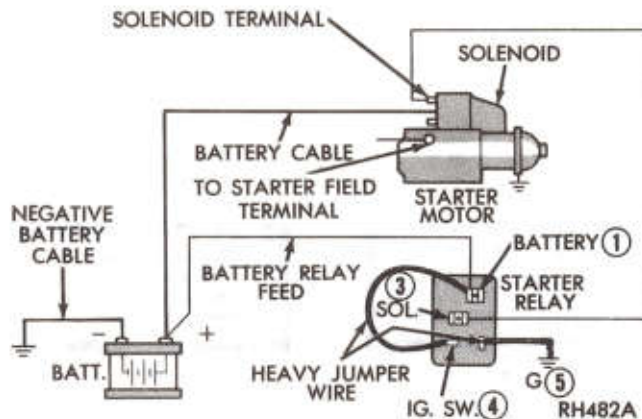


Fig. 5—Relay Test with Two Jumper Wires (Typical)

Bench Testing Starter Solenoid With the Starter Removed From Vehicle

(1) Remove starter motor, see Group 8B, Battery/Starter Service.

(2) Disconnect field coil wire from field coil terminal (Fig. 6).

(3) Check for continuity between solenoid terminal and field coil terminal with a continuity tester. There should be continuity (Fig. 7).

(4) Check for continuity between solenoid terminal and the solenoid housing. There should be continuity (Fig. 8).

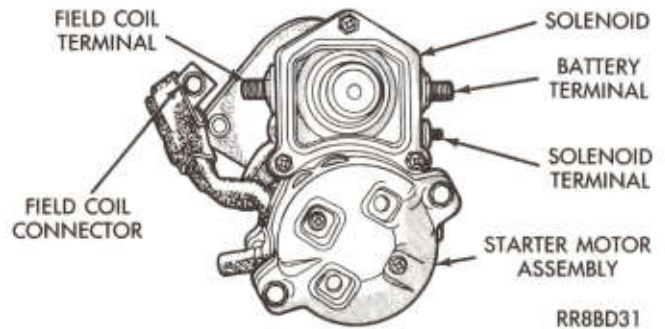


Fig. 6—Field Coil Wire Terminal (Typical)

(5) If there is continuity solenoid is good. If there is no continuity in either test solenoid has an open circuit and is defective. Replace solenoid assembly.

(6) Connect field coil wire to the field coil terminal (Fig. 6).

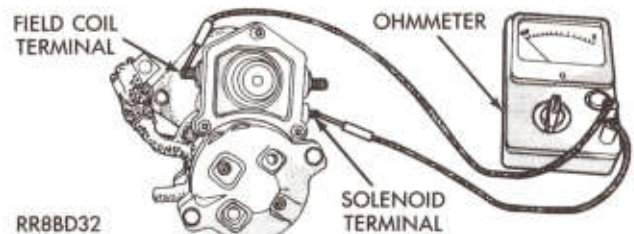


Fig. 7—Continuity Test Between Solenoid Terminal and Field Coil Terminal (Typical)

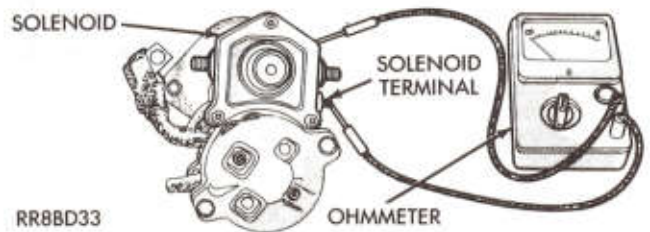
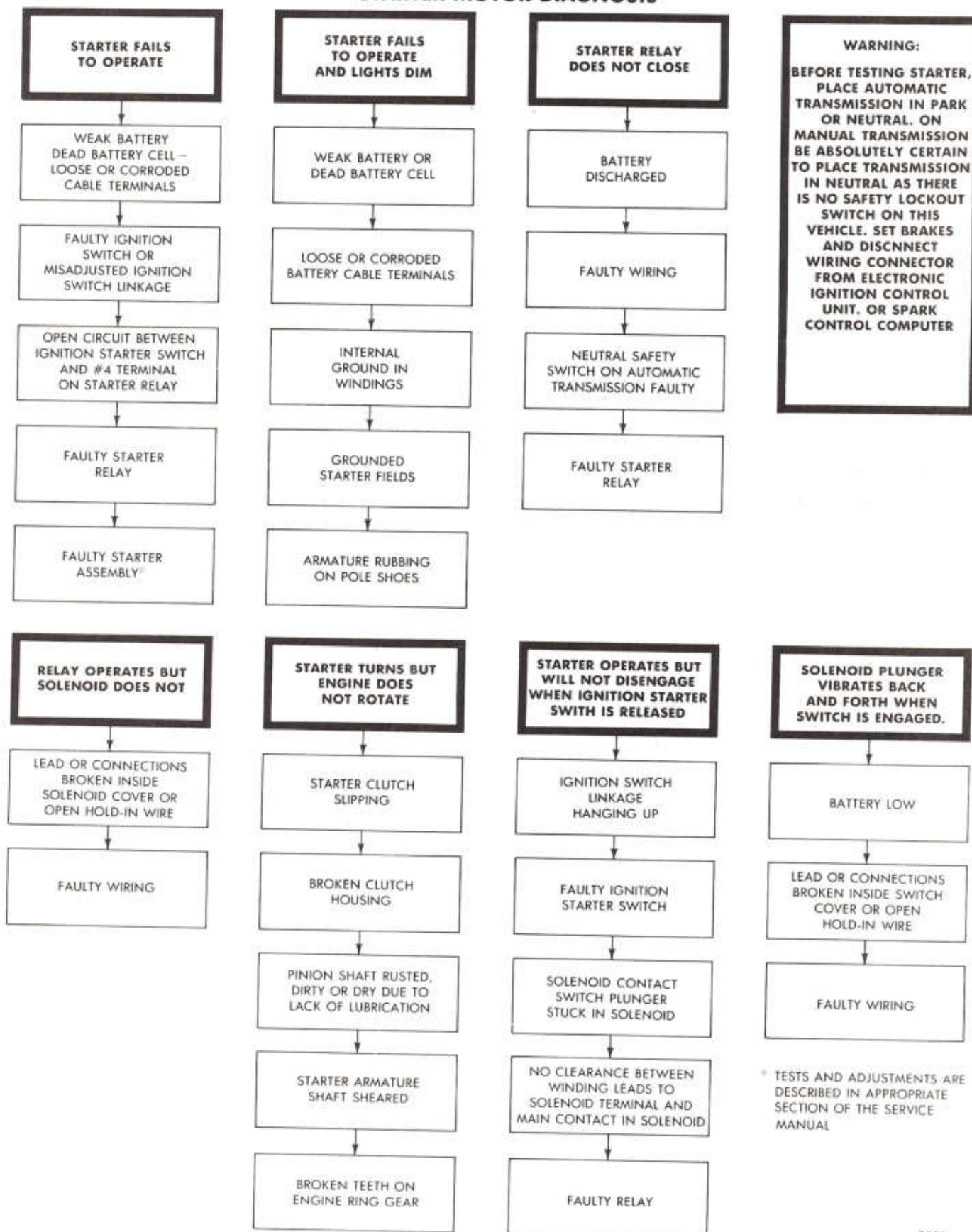


Fig. 8—Continuity Test Between Solenoid Terminal and Solenoid Case (Typical)

STARTER MOTOR DIAGNOSIS



ALTERNATOR TEST PROCEDURES ON VEHICLE TBI ENGINES

INDEX

	Page		Page
Alternator Diagnosis	18	Test 1 B—Checking Charging System For Intermittent Failures	22
Alternator Output Wire Resistance Test	15	Test 2 A—Checking Battery Temperature Sensor Calibration	22
Current Output Test	17	Test 2 B—Checking Charging System Operating Voltage	23
Using On Board Diagnostics System	17	Test 3 A—Checking Battery Voltage Sensing Fault Code 16	23
ATM Test Codes	19	Test 4 A—Checking Alternator Field R3 Circuit Fault Code 41-47	23
Charging System Fault Code Chart	19	Test 4 B—Checking Field R3 Circuit For Short to Ground	23
Diagnostic Tool	19	Test 4 C—Checking R3 Circuit Control in SMEC for Short	24
Engine Running Test Codes	19	Test 5 A—Checking Alternator J2 Field Circuit Fault Codes 41, 41-47, 47	24
Fault Codes	17	Test 5 B—Checking Field Control Wire to SMEC R3 Circuit	24
Indicator Codes	17	Test 5 C—Checking SMEC Charging System Control R31 Circuit	24
How to Use Diagnostic Tool	20	Test 5 D—Checking Charging System Control R31 Circuit	24
Circuit Actuation Test Mode	20		
Diagnostic Mode	20		
Engine Running Test Mode	20		
Erase Fault Codes	20		
Sensor Test Mode	20		
Switch Test Mode	21		
How to Use Check Engine Lamp	21		
Limp in Mode	21		
Battery Voltage too High	22		
Test 1 A—Checking Charging System For Fault Codes	22		

ALTERNATOR OUTPUT WIRE RESISTANCE TEST (FIG. 1)

Alternator output wire resistance test will show amount of "Voltage Drop" across alternator output wire between alternator "Bat" terminal and positive "Battery" post.

Preparation

(1) Before starting test make sure vehicle has a fully charged battery. Test and procedures on how to check for a fully charged battery are shown in "Battery" section of this Group.

(2) Turn Off ignition switch.

(3) Disconnect negative battery cable.

(4) Disconnect alternator output wire from alternator output "Battery" terminal.

(5) Connect a 0-150 ampere scale D.C. ammeter in series between alternator "Bat" terminal and disconnected alternator output wire. Connect **Positive** lead to alternator "Bat" terminal and **Negative** lead to disconnected alternator output wire.

(6) Connect **Positive** lead of a test voltmeter (Range 0-18 volt minimum) to disconnect **alternator output wire**. Connect **Negative** lead of test voltmeter to positive battery cable at positive post.

(7) Remove air hose between SMEC and air cleaner.

(8) Connect one end of a "Jumper Wire" to ground and with other end, probe green R3 circuit post on the back of the alternator.

CAUTION. Do not connect blue J2 lead to ground, circuit damage will result.

(9) Connect an engine tachometer and reconnect **negative** battery battery cable.

(10) Connect a variable carbon pile rheostat (C3950) between battery terminals. **Be sure carbon pile is in "Open" or "Off" position before connecting leads.**

Test

(1) Start engine. **Immediately after starting, reduce engine speed to idle.**

(2) Adjust engine speed and carbon pile to maintain 20 amperes flowing in circuit. Voltmeter reading should not exceed 0.5 volts.

Results

If a higher voltage drop is indicated, inspect, clean and tighten all connections between alternator "Bat" terminal and Positive battery post. A voltage drop test may be performed at each connection to locate connection with excessive resistance. If resistance tested satisfactorily, reduce engine speed, turn off carbon pile and turn off ignition switch.

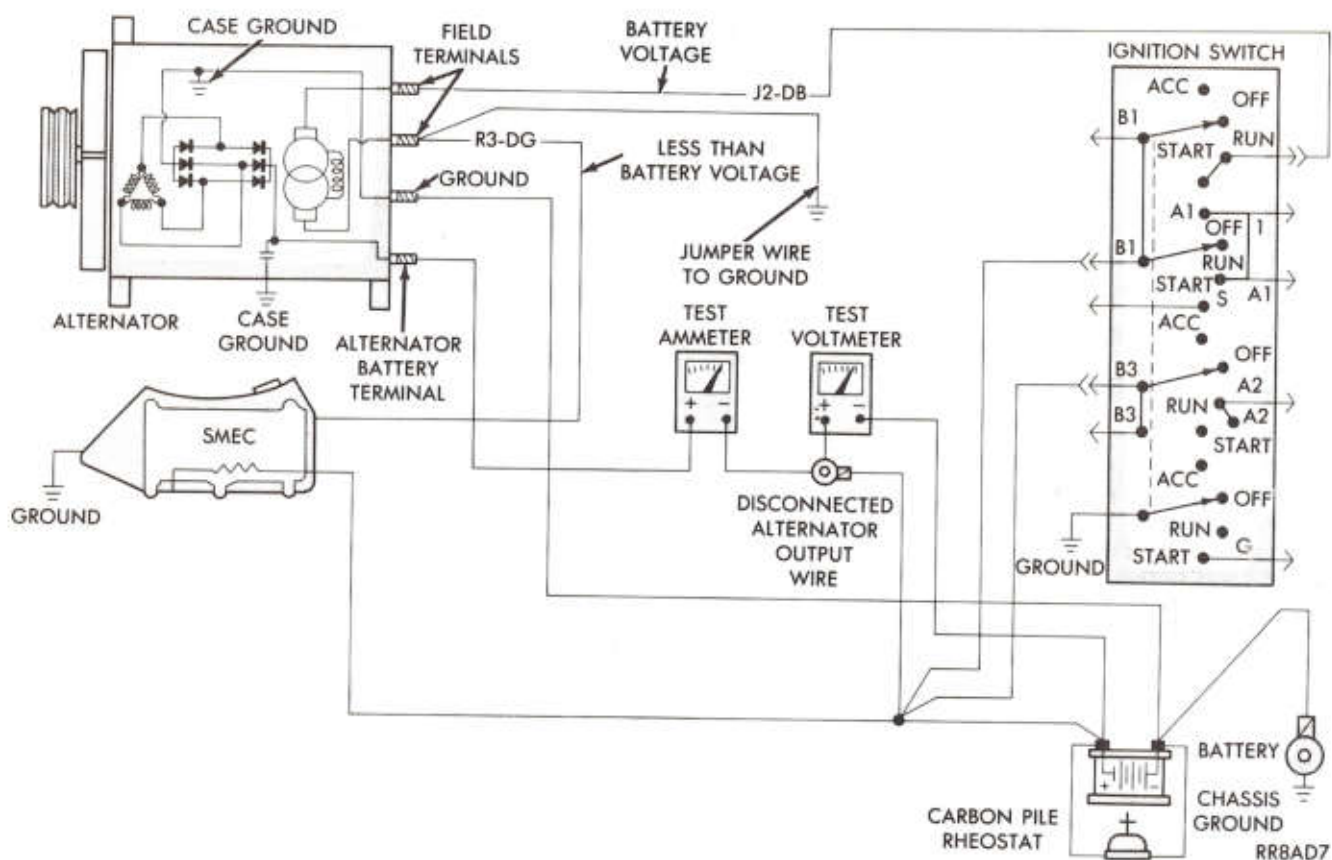


Fig. 1—Alternator Output Wire Resistance Test (Typical)

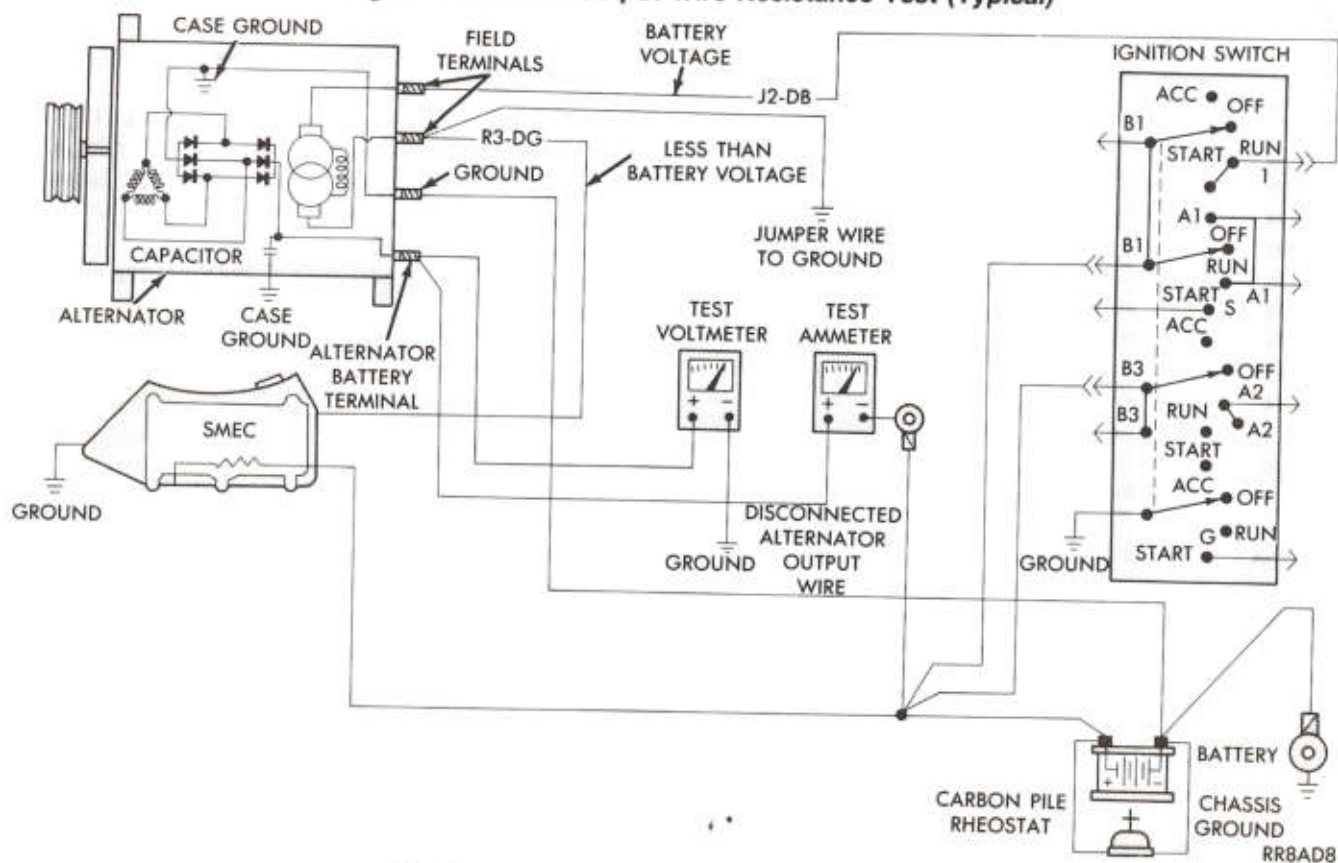


Fig. 2—Alternator Current Output Test (Typical)

- (1) Disconnect negative battery cable.
- (2) Remove test ammeter, voltmeter, carbon pile, and tachometer.
- (3) Remove Jumper Wire from R3 post on back of alternator and ground.
- (4) Connect alternator output wire to alternator "Bat" terminal post. Tighten to 5 to 6 N·m (45 to 75 in. lbs.).
- (5) Reconnect negative battery cable.
- (6) Reconnect hose between SMEC and air cleaner.

CURRENT OUTPUT TEST (FIG. 2)

Current output test determines whether or not alternator is capable of delivering its rated current output.

Preparation

- (1) Before starting any tests make sure vehicle has a fully charged battery. Test and procedures on how to check for a fully charged battery are shown in "Battery" section of this manual.
- (2) Disconnect negative battery cable.
- (3) Disconnect alternator output wire at the alternator battery terminal.
- (4) Connect a 0-150 ampere scale D.C. ammeter in series between alternator "Bat" terminal and disconnected alternator output wire. Connect Positive lead to alternator "Bat" terminal and negative lead to disconnected alternator output wire.
- (5) Connect positive lead of a test voltmeter (range 0-18 volts minimum) to alternator "Bat" terminal.
- (6) Connect negative lead of test voltmeter to a good ground.
- (7) Connect an engine tachometer and reconnect negative battery cable.
- (8) Connect a variable carbon pile rheostat (C3950) between battery terminals. **Be sure carbon pile is in "Open" or "Off" position before connecting leads.**
- (9) Remove air hose between SMEC and air cleaner.
- (10) Connect one end of a "Jumper Wire" to ground and with other end, probe green R3 circuit post on the back of the alternator.

CAUTION: Do not connect blue J2 lead to ground, circuit damage will result.

Test

- (1) Start engine. **Immediately after starting reduce engine speed to idle.**
- (2) Adjust carbon pile and engine speed in increments until a speed of 1250 rpm and voltmeter reading of 15 volts is obtained.

CAUTION: Do not allow voltage meter to read above 16 volts.

- (3) The ammeter reading must be within limits shown in "alternator specification chart" in back of Group 8C, alternator for that size of alternator being tested.

Results

- (1) If reading is less than specified and alternator output wire resistance is not excessive alternator should be removed from vehicle and "bench tested," see Group 8C, "Alternator" for information.
- (2) After current output test is completed reduce engine speed, turn off carbon pile and turn off ignition switch.
- (3) Disconnect negative battery cable.
- (4) Remove test ammeter, voltmeter, tachometer and carbon pile.
- (5) Remove Jumper Wire, from R3 post on back of alternator and ground.
- (6) Connect alternator output wire to alternator "Bat" terminal post.
- (7) Reconnect negative battery cable.
- (8) Reconnect air hose between SMEC and air cleaner.

USING ON-BOARD DIAGNOSTIC SYSTEM

Operation of On-Board Diagnostic System

The Single Module Engine Controller (SMEC) monitors critical input and output circuits of the charging system making sure they are operating correctly. Some are checked continuously and some are only checked under certain conditions.

If on-board diagnostic system senses that one of the critical circuits is bad during a predetermined amount of time during the monitoring cycle, it will consider this a real problem and put a fault code into memory. Each input and output circuit monitored by the OBD system has its own fault code. The fault code will stay in memory as long as the circuit continues to be faulty. However, if the problem does not happen again after the fault code is put into memory, the SMEC is programmed to clear the memory after 20 to 40 engine starts. See "Erasure of Fault Codes" in this section.

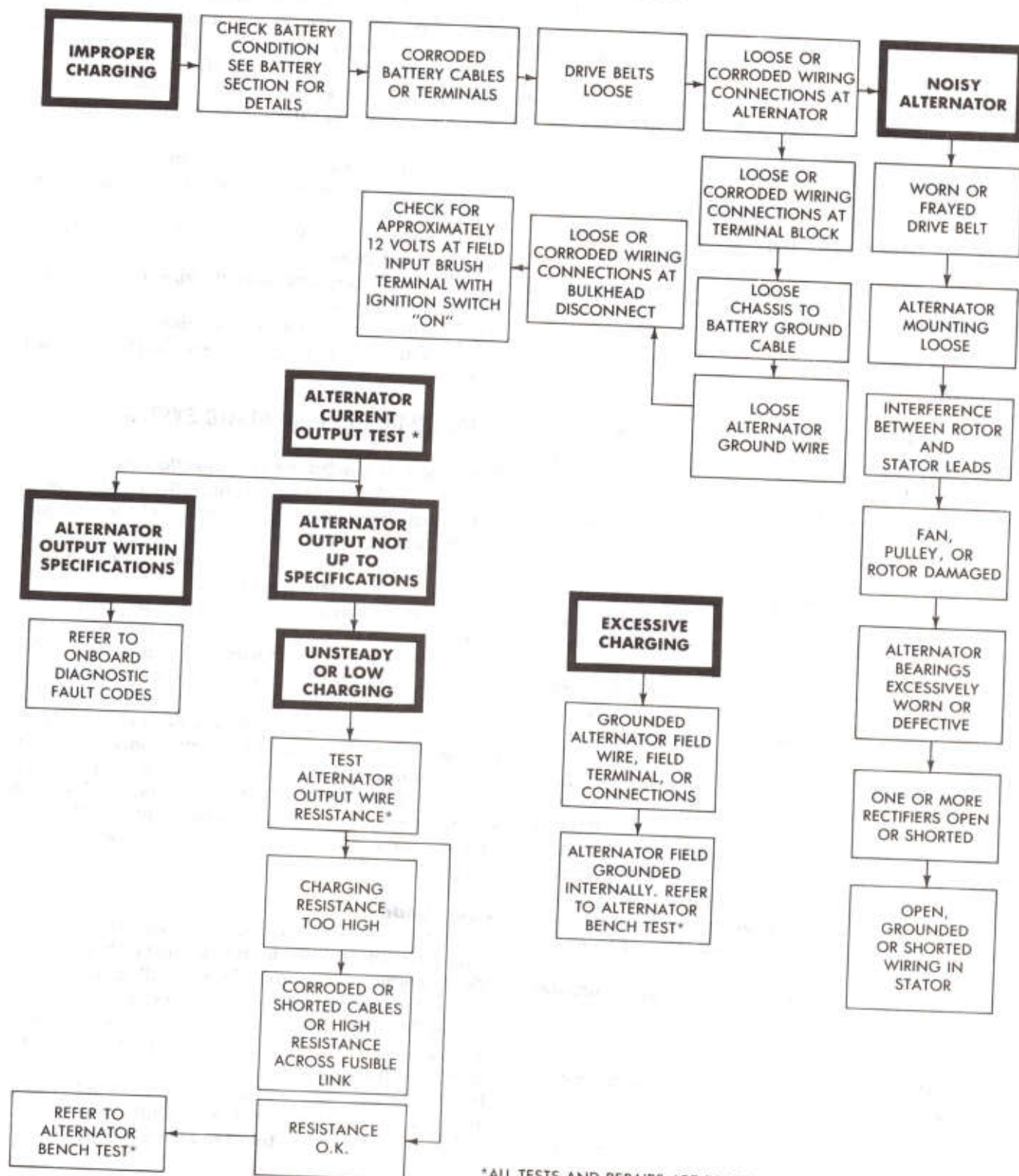
Fault Codes

Fault codes are two-digit numbers that identify which circuit is bad. **In most cases they do not identify which component in a circuit is bad.** Therefore, a fault code is only a "result," not necessarily the "reason" for the problem. However, in some cases, as a result of the design of the driveability test procedure, a fault code can be the "reason" for the problem. It is important that the test procedure be followed in order to understand what the fault codes of the on-board diagnostic system are trying to tell.

Indicator Codes

Indicator codes are two-digit numbers that will tell if certain sequences or conditions have occurred. They are identified and explained in the **Alternator Fault Code Chart.**

ALTERNATOR DIAGNOSIS



*ALL TESTS AND REPAIRS ARE DESCRIBED IN THE APPROPRIATE SECTION OF THE SERVICE MANUAL

CHARGING SYSTEM FAULT CODE CHART

Code	Type	Check Engine Lamp	Circuit	When Monitored By The SMEC	When Put Into Memory	ATM Test Code	Sensor Access Code	Engine Running Test Code
12	Indication	No	Fault Codes Erased	All the time when the ignition switch is on.	If the memory of the single module engine controller (SMEC) has been cleared within the last 50-100 engine starts.	None	None	None
16	Fault	Yes	Battery Voltage Sensing (Charging System)	All the time after one minute from when the engine starts.	If the battery sensing voltage drops below 4 volts for more than 11 seconds.	None	07	67
41	Fault	No	Alternator Field Control (Charging System)	All the time when the ignition switch is on.	If the field control interface fails to switch properly	09	None	None
46	Fault	Yes	Battery Voltage Sensing (Charging System)	When the engine has been running for more than 6 minutes, engine temperature above 160°F and engine rpm above 1,500	If the battery sense voltage is more than 1 volt above the desired control voltage for more than 35 seconds.	None	07	67
47	Fault	No	Battery Voltage Sensing (Charging System)	Engine rpm above 1,500 rpm and A/C off.	If the battery sense voltage is more 1.5 volt below the desired control voltage for more than 30 seconds.	None	07	67
55	Indication	No			Indicates end of diagnostic mode.			
88	Indication	No			Indicates start of diagnostic mode. Note: This code must appear first in the diagnostic mode or fault codes will be inaccurate.			

ATM Test Codes

ATM test codes are two-digit numbers that identify various circuits that you will be using during diagnostics. They are listed in the "Alternator Fault Code Chart."

Sensor Access Code

Sensor access codes will be the same as some ATM test codes. They will be used to access a sensor readout. They are listed in the Alternator Fault Code Chart.

Engine Running Test Codes

Engine running test codes are two digit numbers, they will be used to access sensor readouts while the engine is running. They are listed in the "Alternator Fault Code Chart."

Diagnostic Tool

A diagnostic tool (see Group 14, Fuel Injection) is

used to put the system into a **Diagnostic Test Mode**, **Circuit Actuation Test Mode**, **Switch Test Mode**, **Sensor Test Mode** and **Engine Running Test Mode**. These five modes of testing are required to properly diagnose the system and will be used in the diagnostic test procedure.

The following is a description of each test mode:

Diagnostic Test Mode—This mode is used to see if there are any fault codes stored in the on-board diagnostic system memory.

Circuit Actuation Test Mode (ATM Test)—This mode is used to turn a specific circuit on and off in order to check it. ATM test codes are used in this mode.

Switch Test Mode—This mode is used to determine if specific switch inputs are being received by the logic module.

Sensor Test Mode—This mode is used to see the output signals of certain sensors as received by logic module when engine is not running.

Engine Running Test Mode—This mode is used to

see sensor output signals as received by the logic module while the engine is running. Also, this test mode will be used to establish some specific engine running conditions required for diagnosis.

HOW TO USE DIAGNOSTIC TOOL

Refer to Instructions Provided with Diagnostic Tool

Diagnostic Mode

- (1) Connect diagnostic tool to the OBD connector (Fig. 3).
- (2) Place read/hold switch on diagnostic tool in read position.
- (3) Turn ignition switch on-off-on-off-on within 5 seconds.
- (4) Record all codes, displaying of codes may be stopped by moving read/hold switch to hold position. Returning to read position will continue displaying of codes.

Switch Test Mode

- (1) Make sure all the switches that send an input to the SMEC are turned off.
- (2) Put the system into the diagnostic test mode and wait for 55 to appear on the diagnostic tool display and check engine lamp to stop blinking.
- (3) Turn on the desired switch for input into the SMEC.

If the input is received by the SMEC the display will change to either 00 or 88 when the switch is turned on and then change again when the switch is turned off.

Circuit Actuation Test Mode (ATM Test)

- (1) Put the system into the diagnostic test mode and wait for 55 to appear on the diagnostic tool display and make sure the read/hold switch is in the read position.
- (2) Press and hold the ATM button until the desired ATM test code appears on the display and then release the button.

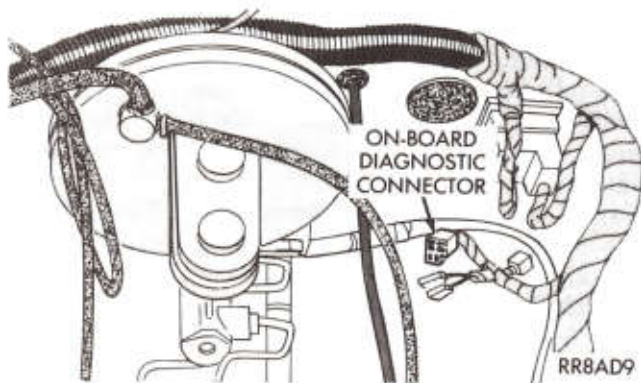


Fig. 3—On-Board Diagnostic Connector Location

The SMEC will turn the selected circuit on and off at 2 second intervals for 5 minutes and then turn the test off. To stop the test before the 5 minute period, turn the ignition switch off.

Sensor Test Mode

- (1) Put the system into the actuation test mode (ATM test).
- (2) Press and hold the ATM button until the desired sensor access code appears on the display and then release the button.
- (3) Move the read/hold switch to the hold position. Since sensor access codes are the same as **some ATM test codes, the ATM test circuit will turn on before moving the read/hold switch to the hold position.**
- (4) The SMEC will now use the diagnostic tool to display the output of the selected sensor. All readings displayed are to be divided by 10 except the coolant sensor which is to be multiplied by 10. Battery voltage is actual and no correction is required.

Erase Fault Codes

- (1) With diagnostic tool in ATM test mode 10, switch read/hold to HOLD position.
- (2) The display will flash alternating 0's.
- (3) When the flashing 0's stop and display shows 00, all fault codes, will be erased.
- (4) Fault codes 88, 11, 12, and 55 will exist until the engine is cranked, at which time the 11 will be eliminated.

Engine Running Test Mode

- (1) Connect diagnostic tool to the mating connector. Make sure read/hold switch is in the **read** position.
- (2) Start engine and observe display of diagnostic tool.
 - (a) When oxygen sensor is at operating temperature, the display will show if O₂ system is switching rich/lean by alternately displaying 0 and 1, (0 = Lean 1 = Rich) when in closed loop.
 - (b) When the engine is running in neutral or park and the O₂ system switch is displayed, idle motor system can be checked by moving the read/hold switch to hold position. Engine speed should increase to approximately 1500 rpm.
 - (c) When engine is running, O₂ switching is displayed and read/hold switch is in **read** position, press and hold ATM button until desired engine running test code appears on the display and then release button. Move read/hold switch to **hold** position. The SMEC will now use the diagnostic tool to display output of selected sensors or it will run engine in a specified mode for diagnosis. All readings displayed are to be divided by 10 except coolant sensor and engine rpm which are to be multiplied by 10. Battery voltage, manifold vacuum, and vehicle speed are actual and no correction is required.

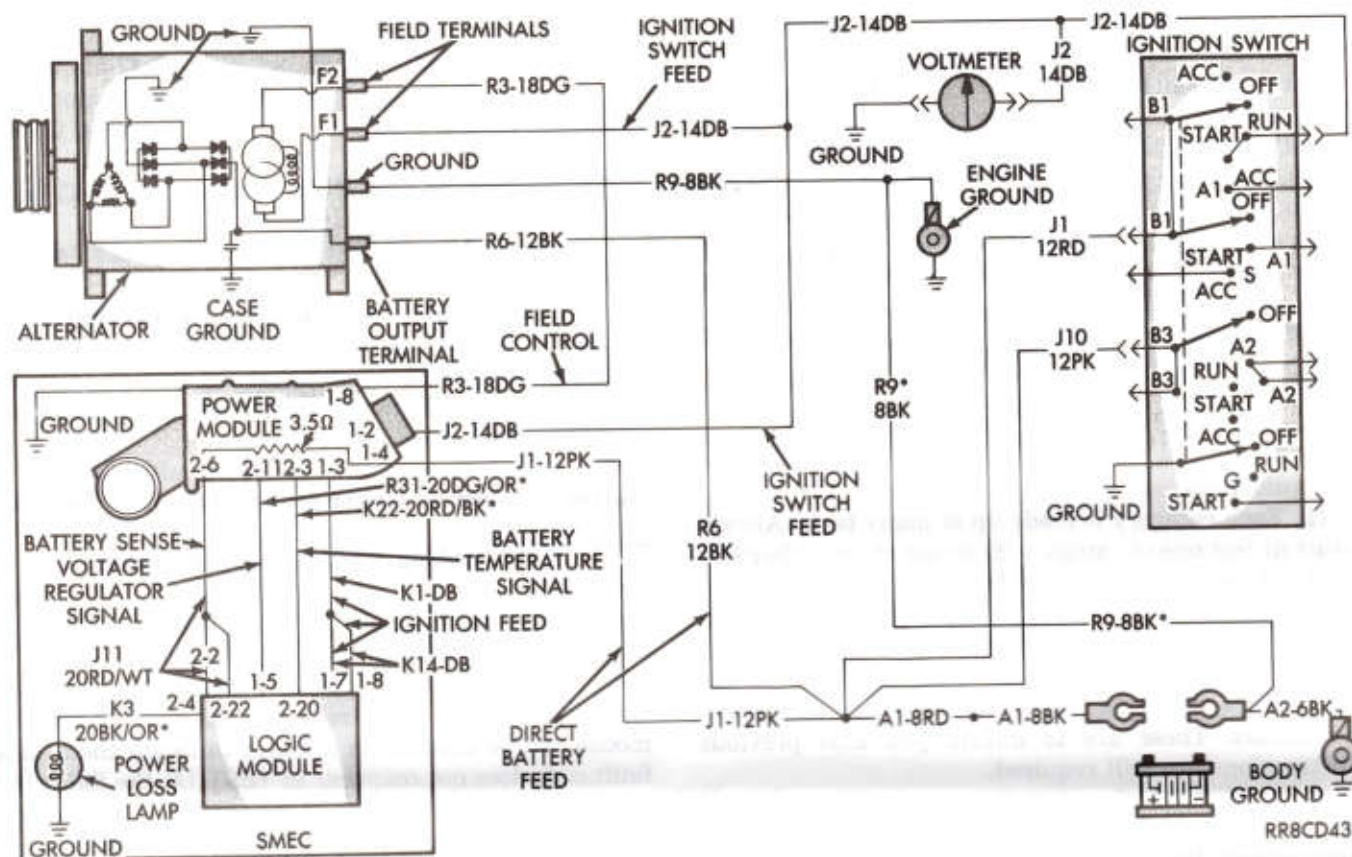


Fig. 4—Charging System (Typical)

HOW TO USE CHECK ENGINE LAMP FOR FAULT CODES (FIG. 4)

If for some reason diagnostic tool is not available, SMEC can show fault codes by means of flashing check engine lamp on instrument cluster.

To activate this function turn ignition key on-off-on-off within five seconds. The check engine lamp will then come on for two seconds as a bulb check. Immediately following this it will display a fault code by flashing on and off. There is a short pause between flashes and a longer pause between digits. All codes displayed are two digit numbers with a four second pause between codes.

An example of a code is as follows:

- (1) Lamp on for two seconds, then turns off.
- (2) Lamp flashes four (4) times pauses and then flashes once (1).
- (3) Lamp pauses for four seconds, flashes four (4) times, pauses and then flashes seven (7) times.

The two codes are 41 and 47. Any number of codes can be displayed as long as they are in memory. The lamp will flash until all of them are displayed (55 = End of test).

Switch Test Mode—After all codes are displayed, switch function can be verified. The lamp will turn on or off when a switch is turned on or off.

Unlike the diagnostic tool the check engine lamp cannot do the following:

- (a) Once the lamp begins to display fault codes, it cannot be stopped. If you lose count it will be necessary to start all over again.
- (b) The lamp cannot display any codes related to 88 diagnoses or blank displays.
- (c) The lamp cannot show you if the oxygen feedback system is switching (lean-rich) and if the idle motor system is operational.
- (d) The lamp cannot perform the actuation test mode sensor test modes, engine running test mode.

Limp-In Mode

If information from critical sensors fails certain on-board diagnostic (OBD) tests, the SMEC goes into a "limp-in" mode, turns on the check engine lamp and substitutes a modified signal in place of the failed one, in order to keep vehicle driveable.

The following is a description of each charging system "limp-in" mode.

- (1) **Battery Voltage Sense**—If this signal drops below 4 volts after the engine has been running for one minute fault code 16 is recorded in memory and the check engine lamp is turned "ON." At this time the SMEC will operate the charging system at a fixed rate.

(2) **Battery Voltage Too High**—If the SMEC senses the battery sense voltage is more than 1 volt above the desired control voltage fault code 46 is recorded in memory and the check engine lamp is turned "ON".

If these two sensor signals return to within specifications while the engine is running the check engine lamp will turn "off" and the charging system will return to normal operation. The fault code will remain in memory for evaluation by the SMEC but will be cleared after 20 to 40 engine starts if the fault does not happen again.

TESTS

Perform tests procedure categories using the following guidelines:

(1) Each category is made up of many tests. Always start at test one of category. Starting at any other test will only give incorrect results.

(2) Each test may have many steps. Only perform steps indicated under action required. It is not necessary to perform all steps in a test. If you do, the problem will not be found. Some steps may have reminders. These are to inform you that previous instructions are still required.

(3) At the end of each test (not step) reconnect all wires and turn the engine off, and reinstall any components that were removed for testing.

(4) The vehicle being tested must have a fully charged battery.

CAUTION: Probe all connector wires from wire end of connector except the 60-way connector whenever possible while making tests. Probing from terminal end of connector may distort or spread terminals.

TEST 1A—Checking charging system for fault codes

(1) Connect diagnostic tool (see Group 14, Fuel Injection) to engine harness connector.

(2) Turn ignition switch on-off-on-off-on within 5 seconds.

(3) If codes 88-12-55 is displayed it indicates no faults proceed to test 2.

(4) If codes 88-12-16-15 is displayed code 16 indicates a battery voltage for charging system fault proceed to test 3.

(5) Record all codes.

(6) Erase the fault codes.

(7) Start engine and run for seven (7) minutes. Raise engine speed to 1500 rpm for 30 seconds.

(8) Turn engine off. Put system in Diagnostic Test Mode.

(9) If codes 88-12-46-55 or 88-12-41-55 is displayed, code 46 or 41-45 indicates an alternator field (charg-

ing system output to high) fault move on to test 4.

(10) If codes 88-12-41-55 or 88-12-41-47-55 is displayed, code 41 or 41-47 indicates an alternator field (charging system output to low) fault move on to test 5.

(11) If codes 88-12-47-55 is displayed code 47 indicates an alternator output fault.

(12) Check for a loose fan belt then check battery and alternator systems.

(13) If the same code appears before and after engine is started and problem still exists check that the diagnostic tool is operational and that there is not an open circuit in the wires between the SMEC and diagnostic connector.

(14) If a code does not reappear after engine is started problem no longer exists, proceed to Test 1B.

TEST 1B—Checking for intermittent failures

The majority of intermittent failures are caused by wiring and connections. The only way to find them is to try and duplicate the problem. Since the SMEC can remember where they are, the ATM and sensor test modes can be used in an attempt to locate them. If a fault code does not reappear in **TEST 1A**, the following procedure should be used to determine if the wiring and connections are the cause of the problem.

(1) If fault code 41 does not reappear use the **ATM Test Mode 09** as indicated.

(2) Connect a voltmeter to the field control (R3) terminal of the alternator and watch pulsations of meter (see Group 8W, Wiring Diagrams).

(3) Once in the correct test mode, wiggle all the connectors and wires in the circuit. When the bad connection or wire is located the ATM test will stop if an open condition occurs.

(4) If fault code 16 does not reappear use the Sensor Mode 07 as indicated.

(5) Once in the correct test mode, wiggle all the connector and wires in the circuit. When the bad connection or wire is located the display on the diagnostic tool will change.

TEST 2A—Checking Battery Temperature Sensor Calibration

(1) Review Test 1A.

(2) Connect a diagnostic tool (see Group 14, Fuel Injection) to diagnostic connector located in engine compartment (Fig. 3).

(3) Select diagnostic mode Engine Running Test 61. If display reads .2 to 3 volts, proceed to Test 2B. If display does not read .2 to 3 volts, replace the SMEC (see Group 8D, Ignition System).

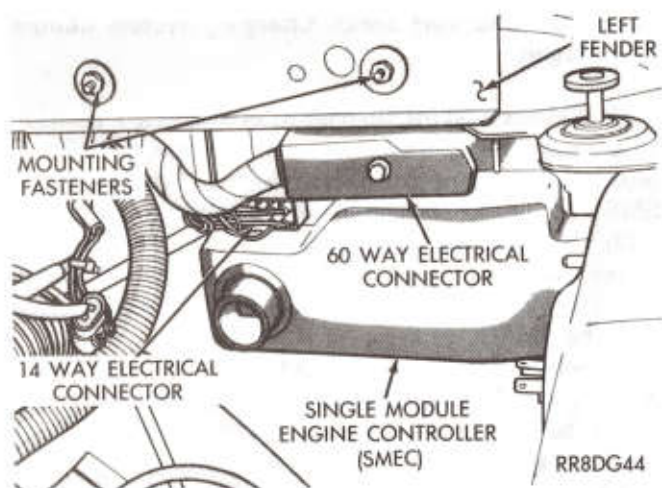


Fig. 1—Location of SMEC

TEST 2B—Checking Charging System Operating Voltage

(1) Review Test 2A.

(2) Select diagnostic mode Engine Running Test 67. If display reads 13 to 15 volts, check for ignition off draw and battery condition (see Battery Test Procedures on Vehicle in this group).

If display does not read 13 to 15 volts, refer to Alternator Output Wire Resistance Test and Current Output Test of this section.

TEST 3A—Checking Battery Voltage Sensing FAULT CODE 16

(1) Review Test 1A, turn ignition to the OFF position.

(2) Disconnect the 60-way connector from the SMEC (Fig. 1).

(3) Connect a voltmeter from cavity 41 of the 60-way harness connector and ground (Fig. 2). If voltmeter reads battery voltage, verify connection between cavity terminal 41 and pin 41 of the SMEC. Replace the SMEC (See Group 8D, Ignition System).

If voltmeter reads 0 volts, repair open in the J1 (16RD) circuit (see Group 8W, Wiring Diagrams).

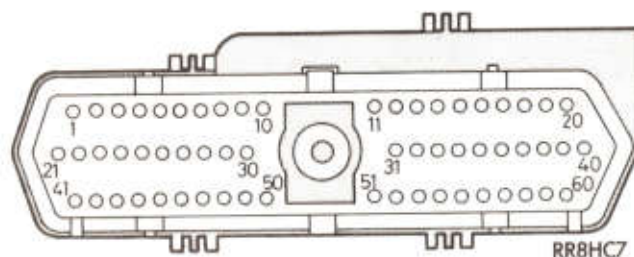


Fig. 2—60-Way Harness Connector at SMEC

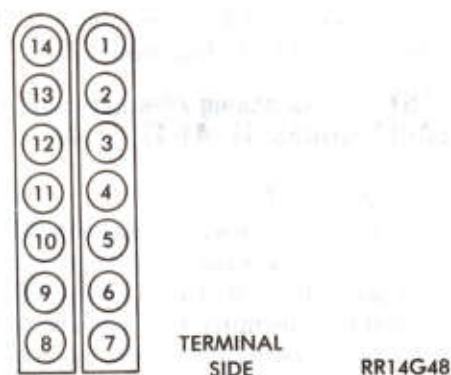


Fig. 3—14-Way Harness Connector at SMEC

TEST 4A—Checking Alternator Field R3 Circuit FAULT CODE 41-46

(1) Review Test 1A, turn ignition to the OFF position.

(2) Disconnect the 14-way connector from the SMEC (Fig. 1) and separate the connector halves (Fig. 3). Plug back into SMEC the half of the connector containing cavities 1-7.

(3) Using an analog voltmeter, connect positive voltmeter lead to cavity 14 (R3-18DG) and negative lead to cavity 11 (R31-20DG/OR) of connector half not plugged into the SMEC.

(4) Select diagnostic mode ATM Test 9. If voltmeter reading is pulsating between 0 and 12 volts, verify the connector to SMEC pin contact. Replace the SMEC (see Group 8D, Ignition System).

If voltmeter reads 0, proceed to Test 4B.

TEST 4B—Checking Field R3 Circuit for Short to Ground

(1) Review Test 4A. With the (8-14) half of 14-way connector unplugged from SMEC, connect positive voltmeter lead to cavity 14 (R3-18DG) and negative lead to ground, switch ignition to the RUN position. If voltmeter reads battery voltage, proceed to Test 4C.

If voltmeter reads 0-1 volt, repair short to ground in R3 circuit (see Group 8W, Wiring Diagrams).

TEST 4C—Checking R3 Circuit Control in SMEC for Short

(1) Review Test 4B. With the (8-14) half of 14-way connector unplugged from SMEC, ignition in OFF position.

(2) Disconnect the 60-Way connector from the SMEC (Fig. 1). Using an ohmmeter, test for continuity from cavity 14 of the 60-way connector to ground (Fig. 2). If no continuity is detected, verify condition of terminal in cavity 14 of 60-way connector. Replace the SMEC.

If continuity is detected, repair R3-18DG circuit (see Group 8W, Wiring Diagrams).

TEST 5A—Checking Alternator J2 (DB) Field Circuit FAULT CODES 41, 41-47, or 47

- (1) Review Test 1A.
- (2) Select diagnostic test mode ATM Test 09.
- (3) Using a voltmeter, connect the negative voltmeter lead to ground. Touch the positive voltmeter lead to each field terminal (2) on the back of the alternator. If voltmeter reads 0 volts at both field terminals, repair open in J2 circuit (see Group 8W, Wiring Diagrams).

If voltmeter reads battery voltage at one field terminal and pulsating between 0 and battery voltage at the other field terminal, check condition of drive belt, refer to Alternator Output Wire Resistance Test and Current Output Test of this section.

If voltmeter reads battery voltage at both field terminals, proceed to Test 5B.

TEST 5B—Checking Field Control Wire to SMEC R3 Circuit

- (1) Review Test 5A, turn ignition to the OFF position.
- (2) Disconnect the 14-way connector from the SMEC (Fig. 1).
- (3) Connect a voltmeter to Cavity 14 (R3-18DG) of the 14-way connector (Fig. 3) and ground. Turn ignition to the RUN position. If voltmeter reads battery voltage, proceed to Test 5C.

If voltmeter reads 0 volts, repair open in R3 circuit from 14-way connector to alternator (see Group 8W, Wiring Diagrams).

TEST 5C—Checking SMEC Charging System Control R31 Circuit

(1) Review Test 5B, turn ignition to the OFF position. Disconnect the 14-way connector from the SMEC and separate the connector halves (Fig. 3). Plug back into SMEC the half of the connector containing cavities 1-7.

(2) Using an analog voltmeter, connect positive voltmeter lead to cavity 14 (R3-18DG) and negative lead to cavity 11 (R31-20DG/OR) of connector half not plugged into the SMEC.

(3) Select diagnostic mode ATM Test 9. If voltmeter reading is pulsating between 0 and 12 volts, verify the cavity terminal to SMEC pin contact. Replace the SMEC (see Group 8D, Ignition System).

If voltmeter reads 0, proceed to Test 5D.

TEST 5D—Checking Charging System Control R31 Circuit

(1) Review Test 5C, turn ignition to the OFF position, disconnect the 60-way and 14-way connectors from the SMEC (Fig. 1).

(2) Using an ohmmeter, test for continuity from cavity 14 of 60-way connector (Fig. 2) and cavity 11 of the 14-way connector (Fig. 3). If continuity is detected, verify condition of terminals in cavities involved. Replace the SMEC (see Group 8D, Ignition System).

If no continuity is detected, repair open in R31 circuit from 60-way to 14-way connectors (see Group 8W, Wiring Diagrams).

ALTERNATOR/VOLTAGE REGULATOR TEST PROCEDURES ON VEHICLE CARBURETED ENGINE

INDEX

	Page		Page
Alternator and Electronic Regulator Diagnosis ...	31	Electronic Voltage Regulator Test when Tester	
Alternator Output Wire Resistance Test	25	C4133 is Not Available	27
Current Output Test	27	Voltage Chart	28
Electronic Voltage Regulator Test with			
Tester C-4133	29		

ALTERNATOR OUTPUT WIRE RESISTANCE TESTS (Fig. 1)

Alternator output wire resistance test will show amount of "Voltage Drop" across alternator output wire between alternator "Bat" terminal and positive "Battery" post.

Preparation

- (1) Before starting any tests make sure vehicle has a fully charged battery. Test and procedures on how to check for a fully charged battery are shown in "Battery" section of this manual.
- (2) Turn Off ignition switch.
- (3) Disconnect negative battery cable (Fig. 2).
- (4) Disconnect alternator output wire from alterna-

tor output "Battery" terminal.

(5) Connect a 0-100 amps minimum range scale D.C. test ammeter in series between alternator "Bat" terminal and disconnected alternator output wire. Connect ammeter Positive lead wire to alternator "Bat" terminal and Negative ammeter lead to disconnected alternator output wire.

(6) Connect a 0-18 volt minimum range scale test Voltmeter between disconnected alternator output wire and Positive battery cable. Connect voltmeter Positive lead to disconnected alternator output wire and Negative voltmeter lead to battery Positive cable at battery post.

(7) Disconnect wiring harness connector from Electronic Voltage Regulator on vehicle (Fig. 3).

(8) Connect a "Jumper" wire from wiring harness

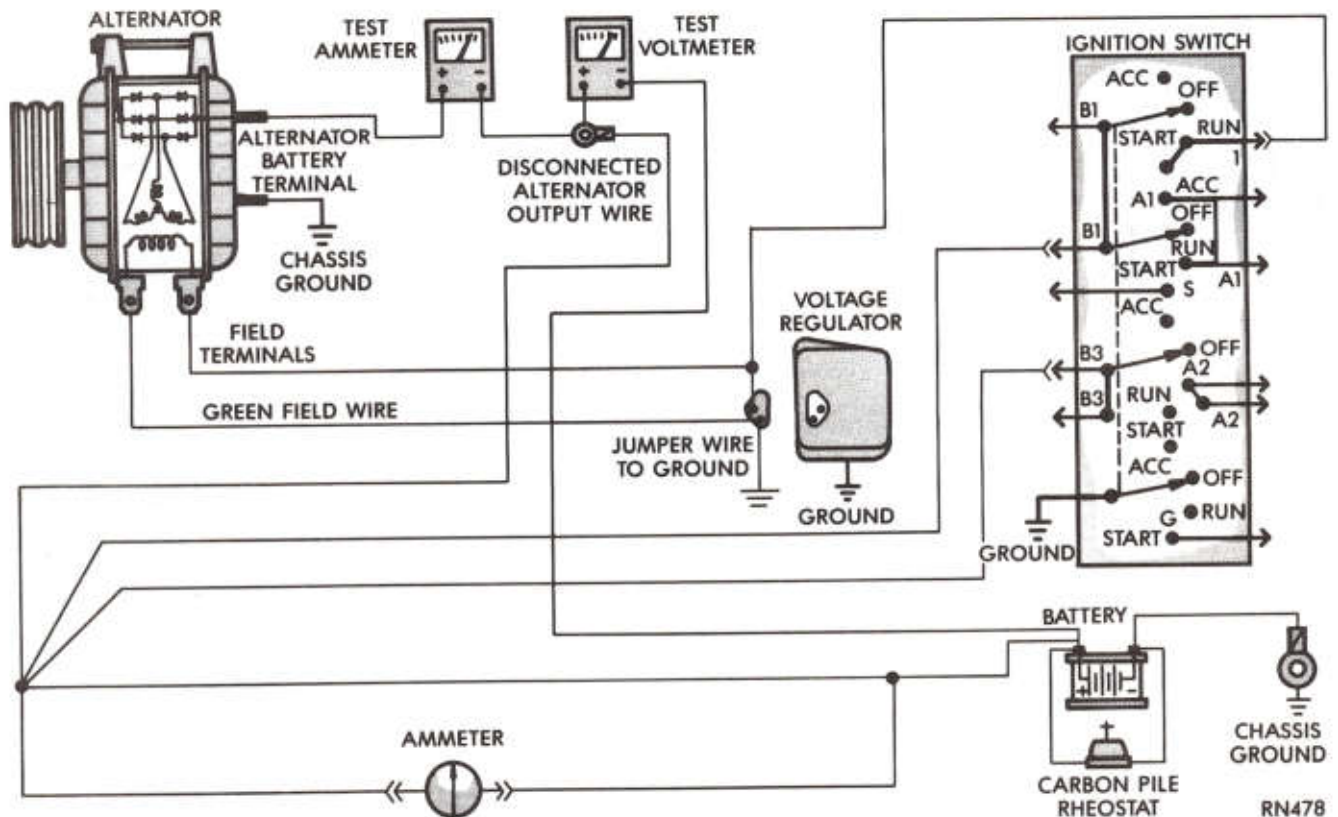


Fig. 1—Alternator Output Wire Resistance Test (Typical)

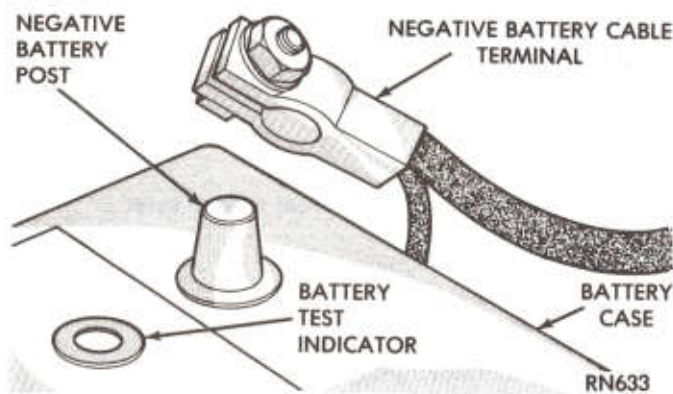


Fig. 2—Removing Negative Battery Cable

connector green wire (outside terminal) to ground.
CAUTION: Do not connect blue J2 lead or wiring connector to ground. Do not spread connector terminals with jumper wire.

(9) Connect an engine tachometer and reconnect Negative battery cable.

(10) Connect a variable carbon pile rheostat (C3950) between battery terminals. Be sure carbon pile is in "Open" or "Off" position before connecting leads.

Test

(1) Start engine. Immediately after starting, reduce engine speed to idle.

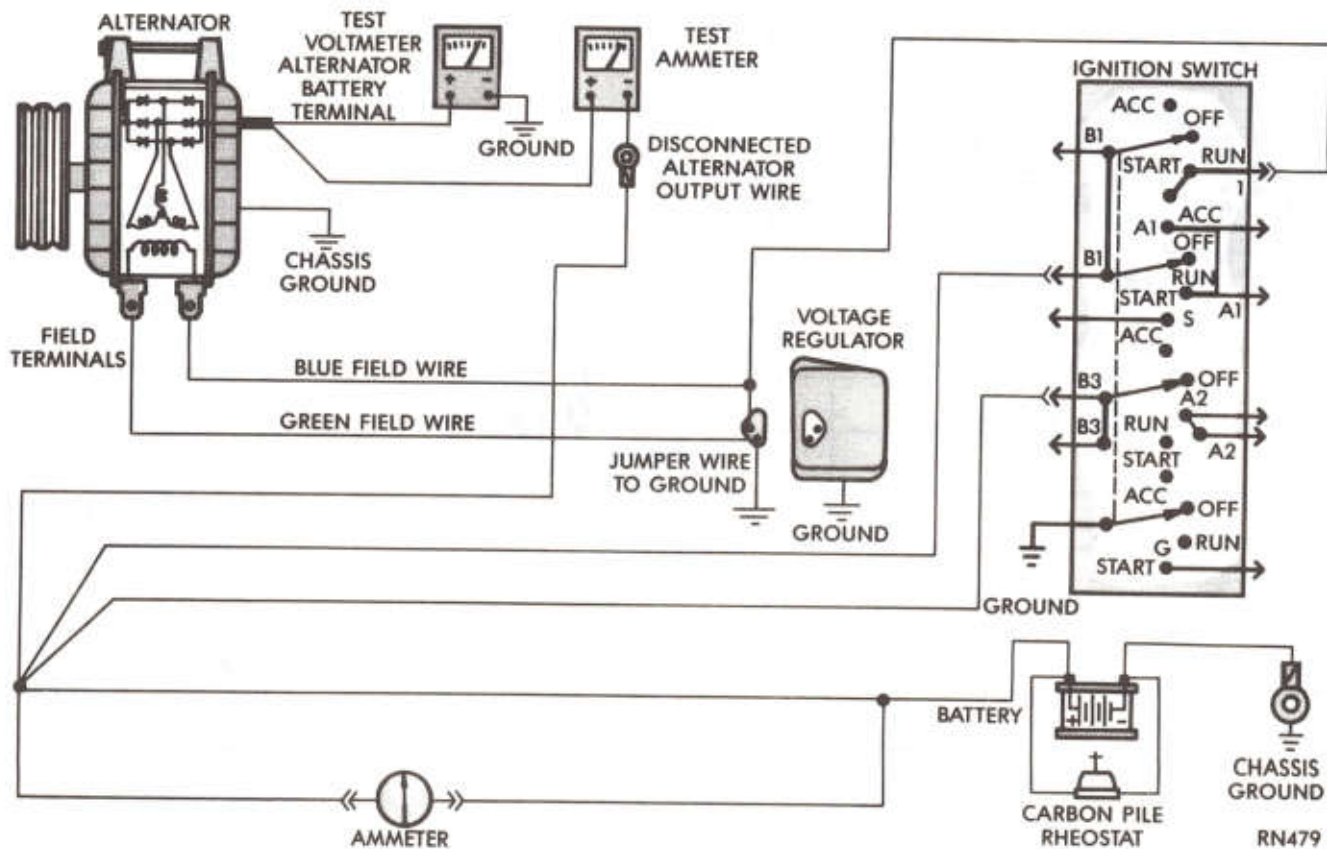


Fig. 4—Current Output Test (Typical)

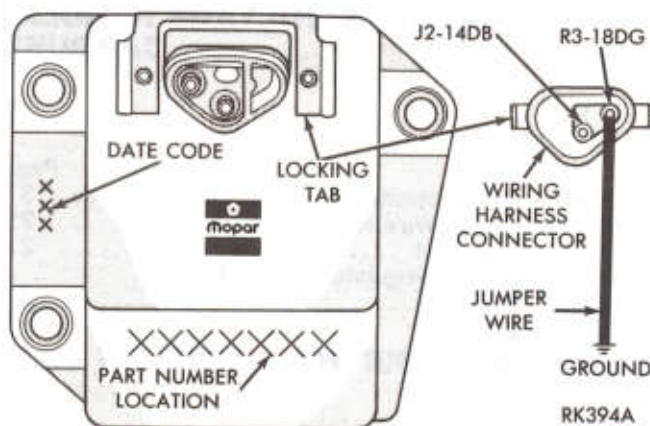


Fig. 3—Jumping Connector Green Wire to Ground

(2) Adjust engine speed and carbon pile to maintain 20 amperes flowing in circuit. Observe voltmeter reading. Voltmeter reading should not exceed 0.5 volts.

Results

If a higher voltage drop is indicated, inspect, clean and tighten all connections in alternator output wire circuit. A voltage drop test may be performed at each connection to locate connection with excessive resistance. If resistance tested satisfactorily, reduce engine speed, turn Off carbon pile and turn Off ignition switch.

- (1) Disconnect negative battery cable.
- (2) Remove test ammeter, test voltmeter, variable carbon pile rheostat and engine tachometer.
- (3) Remove "Jumper Wire" connected between Electronic Voltage Regulator wiring harness connector green wire terminal and ground.
- (4) Connect wiring harness connector to Electronic Voltage Regulator.
- (5) Connect alternator output wire to alternator "Bat" terminal.
- (6) Connect negative battery cable.

CURRENT OUTPUT TEST (Fig. 4)

The current output test determines whether or not the alternator is capable of delivering its rated current output.

Preparation

- (1) Before starting any tests make sure vehicle has a fully charged battery. Test and procedures on how to check for a fully charged battery are shown in "Battery" section of this manual.
- (2) Turn Off ignition switch.
- (3) Disconnect negative battery cable (Fig. 5).
- (4) Disconnect alternator output wire from alternator "Bat" terminal.
- (5) Connect a 0-100 amps minimum range scale D.C. test ammeter in series between alternator "Bat" terminal and disconnected alternator output wire. Connect ammeter Positive lead wire to alternator "Bat" terminal and Negative ammeter lead to disconnected alternator output wire.
- (6) Connect a 0-18 volt minimum range scale test Voltmeter between alternator "Bat" terminal and ground. Connect voltmeter Positive lead to alternator "Bat" terminal. Connect Negative lead of test voltmeter to a good ground.
- (7) Disconnect wiring harness connector from Electronic Voltage Regulator on vehicle (Fig. 5).
- (8) Connect a "Jumper" wire from wiring harness connector green wire (outside terminal) to ground (Fig. 6).

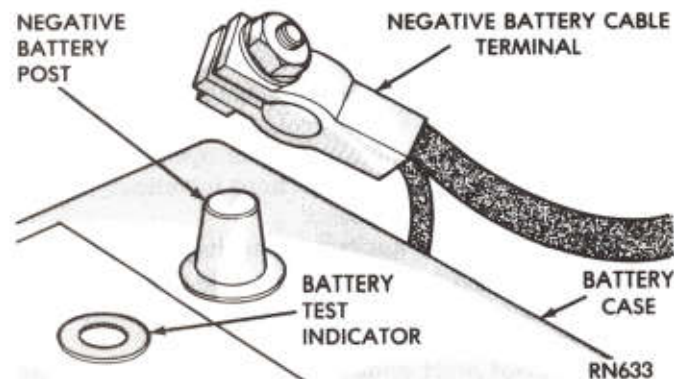


Fig. 5—Removing Negative Battery Cable

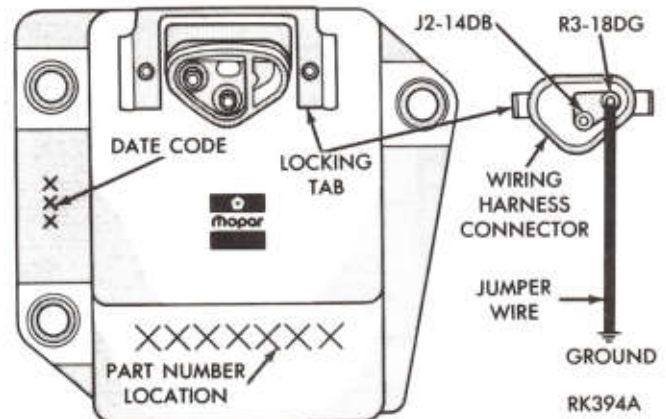


Fig. 6—Jumping Connector Green Wire to Ground

CAUTION: Do not connect blue J2 lead of wiring connector to ground. Do not spread connector terminals with jumper wire.

- (9) Connect an engine tachometer and reconnect negative battery cable.
- (10) Connect a variable carbon pile rheostat between battery terminals. **Be sure the carbon pile is in "Open" or "off" position before connecting leads.**

Test

- (1) Start engine. **Immediately after starting, reduce engine speed to idle.**
- (2) Adjust carbon pile and engine speed in increments until a speed of 1250 rpm and voltmeter reading of 15 volts is obtained.

CAUTION: Do not allow voltage meter to read above 16 volts.

Results

- (1) Ammeter reading must be within limits shown in "alternator specification chart" in back of this group for that size of alternator being tested. If reading is less than specified and if alternator output wire resistance is not excessive, alternator should be removed from vehicle and "bench tested".
- (2) After current output test is completed reduce engine speed, turn off carbon pile and turn off ignition switch.
- (3) Disconnect negative battery cable.
- (4) Remove test ammeter, test voltmeter, tachometer and variable carbon pile rheostat.
- (5) Remove "Jumper Wire" connected between Electronic Voltage Regulator wiring harness connector green wire terminal and ground.
- (6) Connect wiring harness connector to Electronic Voltage Regulator.
- (7) Connect alternator output wire to alternator "Bat" terminal.
- (8) Connect negative battery cable.

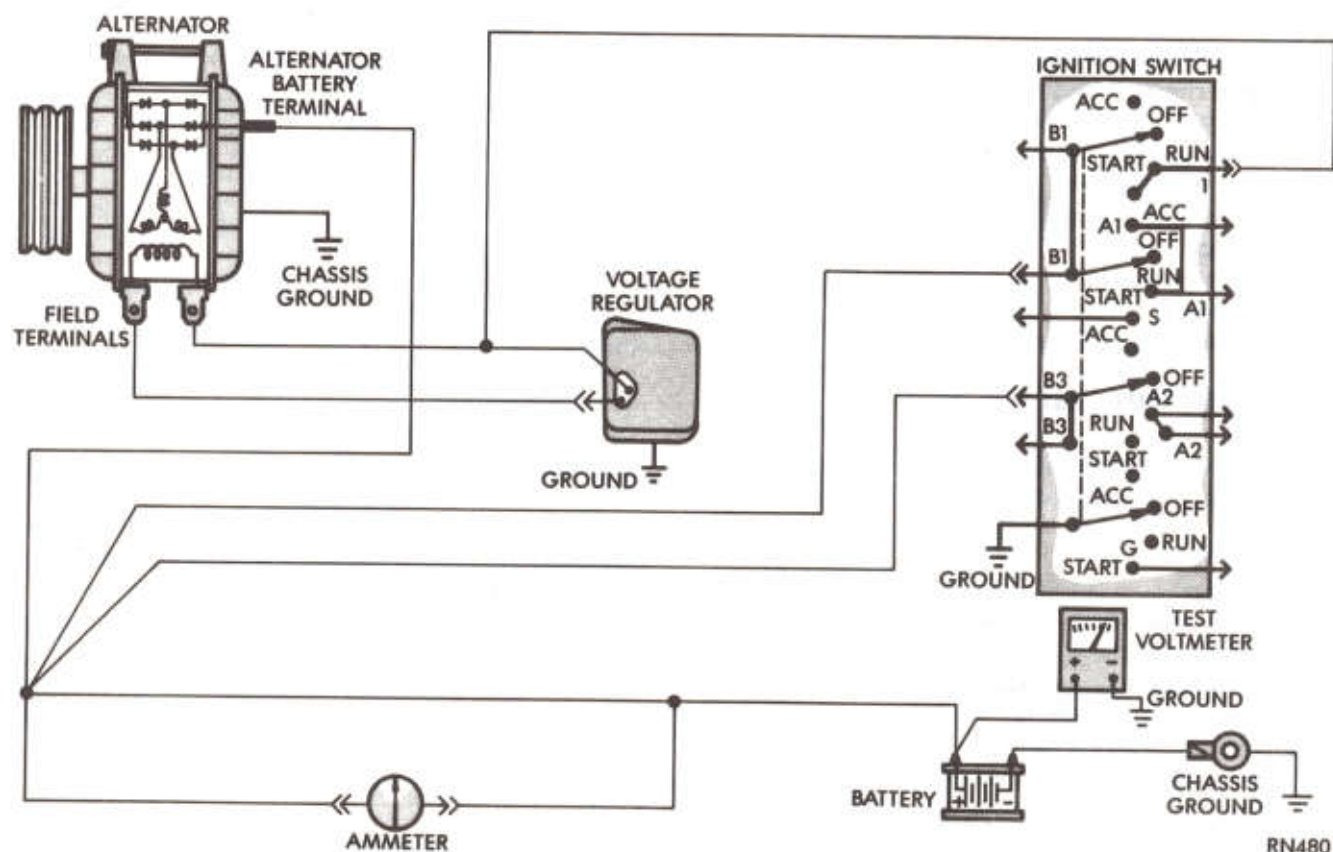


Fig. 1—Voltage Regulator Test (Typical)

VOLTAGE REGULATOR TEST (When Tester C-4133 is Not Available) (Fig. 1)

The voltage regulator test determines whether or not the voltage regulator is capable of regulating electrical system voltage at its rated value.

Preparation

(1) Before starting any tests make sure vehicle has a fully charged battery. Test and procedures on how to check for a fully charged battery are shown in "Battery section" of this manual.

(2) Turn Off ignition switch.

(3) Connect a 0-18 volts minimum range scale test voltmeter between vehicle battery and ground. Connect positive lead of voltmeter to Positive battery cable. Connect negative lead of voltmeter to a good chassis ground.

(4) Connect a tachometer to engine.

Test

(1) Start engine and adjust engine speed to 1250 rpm with all lights and accessories turned off.

Results

(1) Observe voltmeter readings. Regulator is working properly if voltage readings are in accordance with the

voltage chart.

(2) If voltage is above or below limits or is fluctuating, proceed as follows:

VOLTAGE CHART	
Ambient Temperature Near Voltage Regulator	Voltage Range
-30 °C -20 °F	14.9 to 15.8
20 °C 80 °F	13.9 to 14.4
60 °C 140 °F	13.0 to 13.7
Above 60 °C Above 140 °F	Lesss than 13.60

(a) Check for a good voltage regulator ground. Voltage regulator ground is obtained through regulator case, mounting screws and sheet metal of vehicle. This ground circuit should be checked for opens. If "Open" circuit is found clean all connections in voltage regulator ground circuit and retest.

(b) Turn Off ignition switch and disconnect voltage regulator wiring harness connector. Be sure terminals of connector have not spread open to cause an open or intermittent connection.

(c) **Do not start engine or distort terminals with voltmeter probe:** Turn On ignition switch, check for

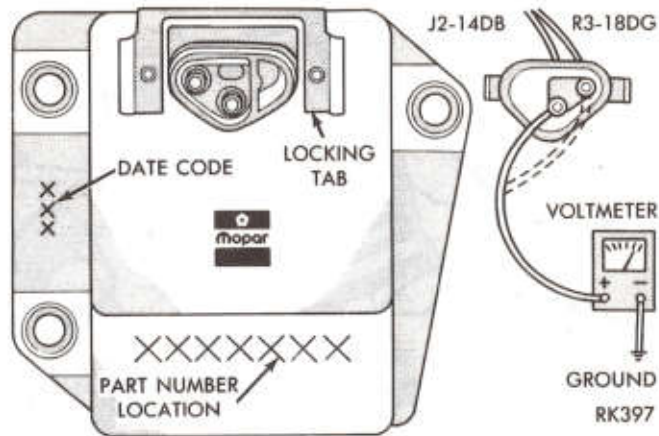


Fig. 2—Testing for Battery Voltage at Both Voltage Regulator Connector Pins

battery voltage at Voltage Regulator wiring harness connector terminals. Both blue and green terminals should read battery voltage (Fig. 2). Turn Off ignition switch.

(d) If battery voltage is not present in step "2C" condition is in wiring. Check wiring diagrams for complete wiring circuit.

(e) If previous steps 1a through 1c tested satisfactory, then replace regulator and repeat test.

(3) Remove test voltmeter and tachometer.

ELECTRONIC VOLTAGE REGULATOR TEST (With Tester C-4133) (Fig. 3)

(1) Disconnect wiring harness connector from Electronic Voltage Regulator on vehicle.

(2) Plug in power cord of Voltage Regulator Tester to 110 Volt A.C. 60 cycle source.

(3) Connect ground wire from Electronic Voltage Regulator tester to a good body ground near regulator,

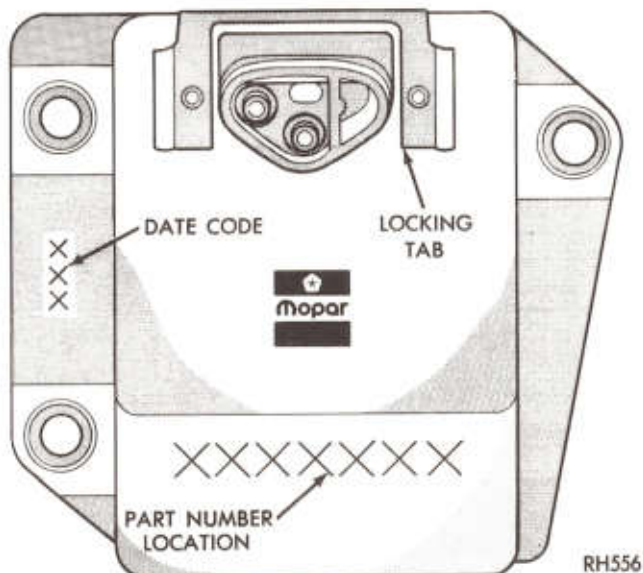


Fig. 3—Voltage Regulator Identification

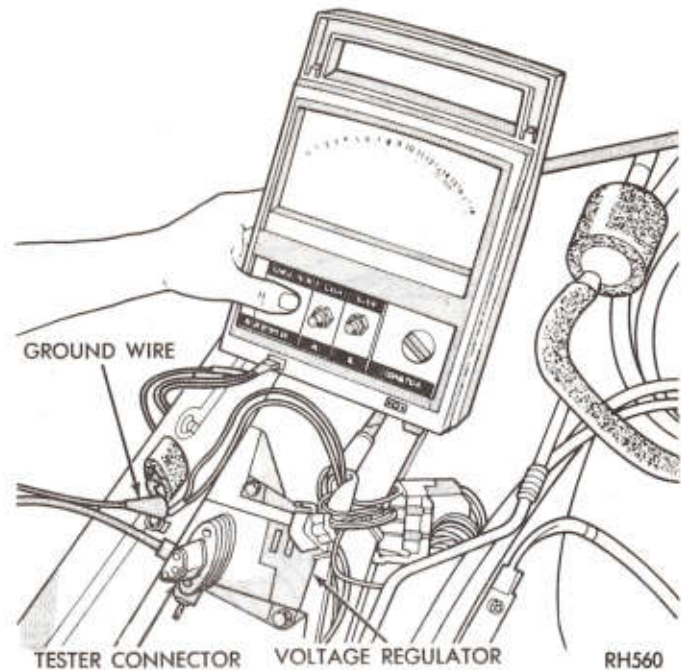


Fig. 4—Depressing Voltage Regulator Test Button

(A place free of paint).

(4) Plug connector of Voltage Regulator Tester into voltage regulator on vehicle.

(5) Place knob on tester to regulator test position.

(6) Press test button on Voltage Regulator Tester (Fig. 4). Voltage reading should be within limits as follows:

(a) If Voltage Regulator temperature is at room temperature 27° (80°F) or above, meter reading should be in the green or yellow range.

(b) If Voltage Regulator temperature is at room temperature 27°C (80°F) or below, meter reading should be in the green or blue range.

(7) While holding test button in, depress Black Button (A) (Fig. 5), meter reading should remain within limits as follows:

(a) If Voltage Regulator temperature is at room temperature 27°C (80°F) or above, meter reading should be in the green or yellow range.

(b) If Voltage Regulator temperature is at room temperature 27°C (80°F) or below, meter reading should be in the green or blue range.

(8) While holding test button in, depress Red Button (B) (Fig. 6) the meter should read above 0.7 volts.

(9) If all tests remain within limits, voltage regulator is good.

(10) If regulator tests defective by this procedure, do not replace it until ground circuit of regulator has been checked.

This is done by moving ground lead of tester from body ground and connecting it to connector locking bracket of regulator. Scrape paint from bracket to insure good ground connection.

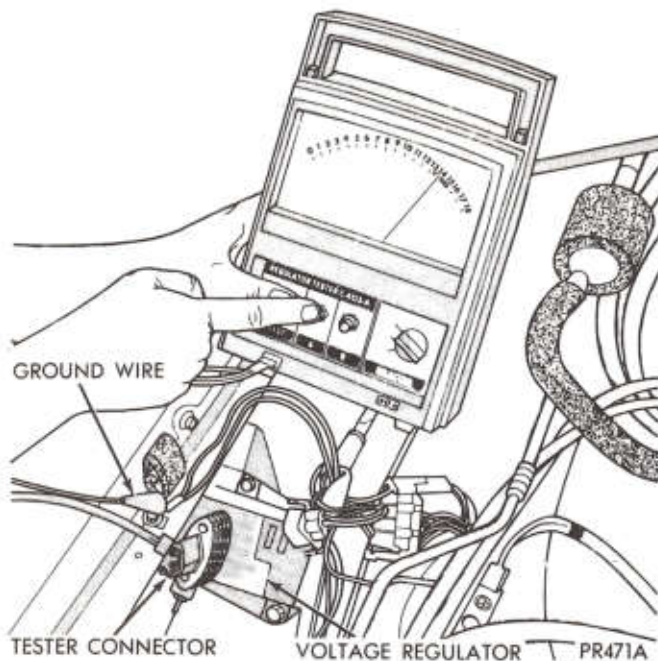


Fig. 5—Voltage Regulator Test Depressing Button "A"

Repeat test procedure and if regulator now tests good this indicates an open ground circuit between regulator case and mounting surface. If regulator does not test okay, replace.

Remove regulator and clean all dirt and corrosion

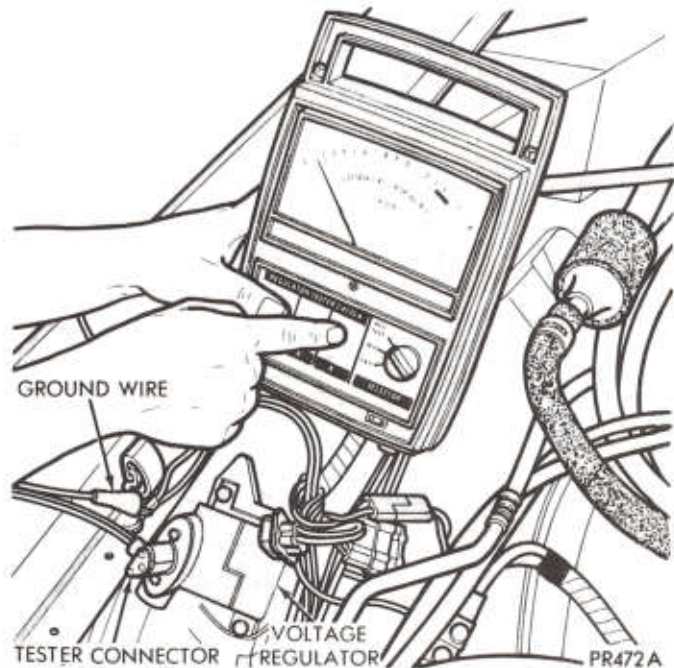
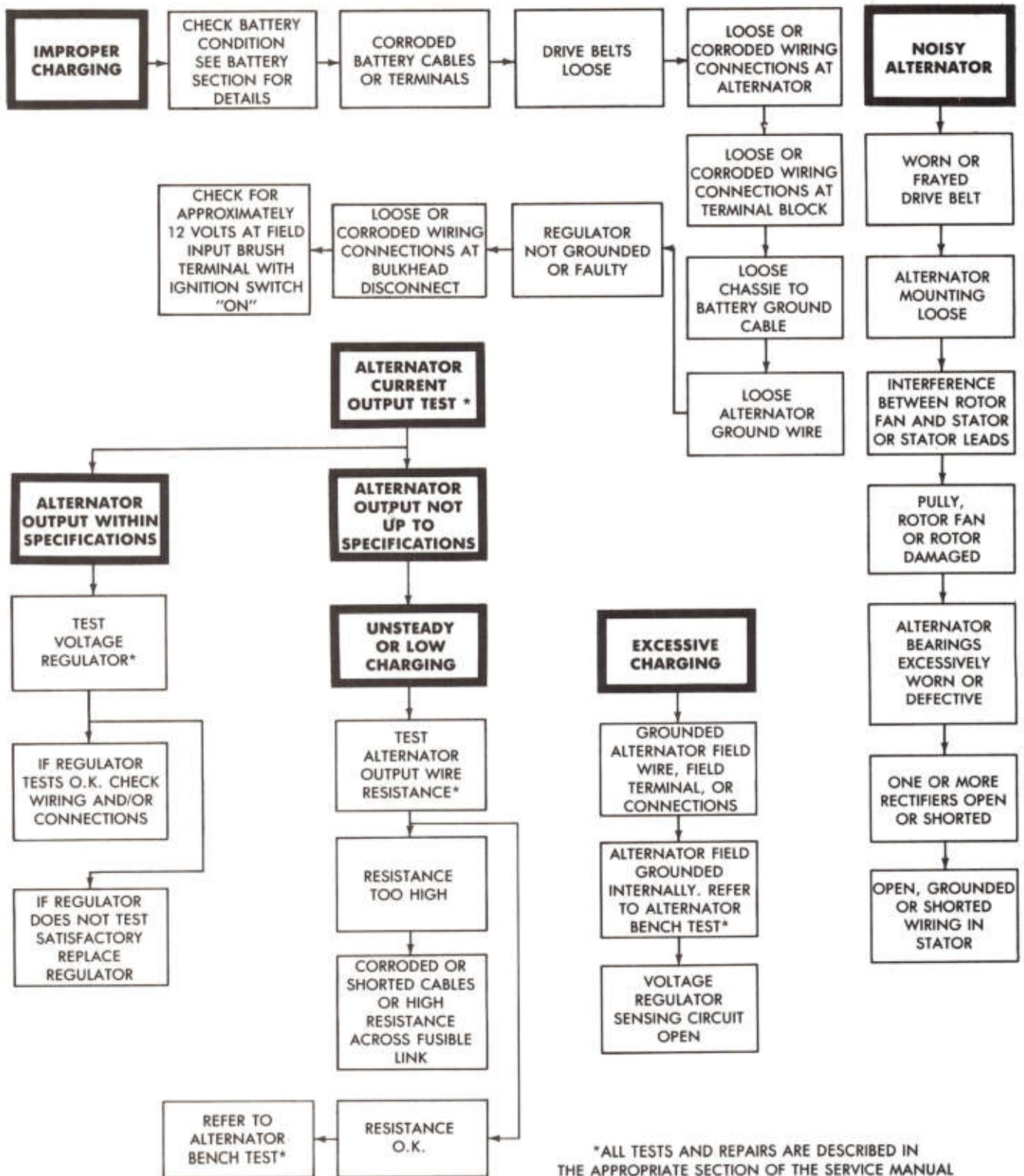


Fig. 6—Voltage Regulator Test Depressing Button "B"

from regulator cover, mounting screws and mounting surface including threaded holes.

Tester may be used as a D.C. Voltmeter by placing tester knob in either the 18 volt or 1.8 volt position. Use red probe and black clip leads for testing.

ALTERNATOR AND ELECTRONIC VOLTAGE REGULATOR DIAGNOSIS



BATTERY/STARTER SERVICE

CONTENTS

BATTERY SERVICE PROCEDURES	Page 1	STARTER SERVICE PROCEDURES	Page 3
SPECIFICATIONS	9		

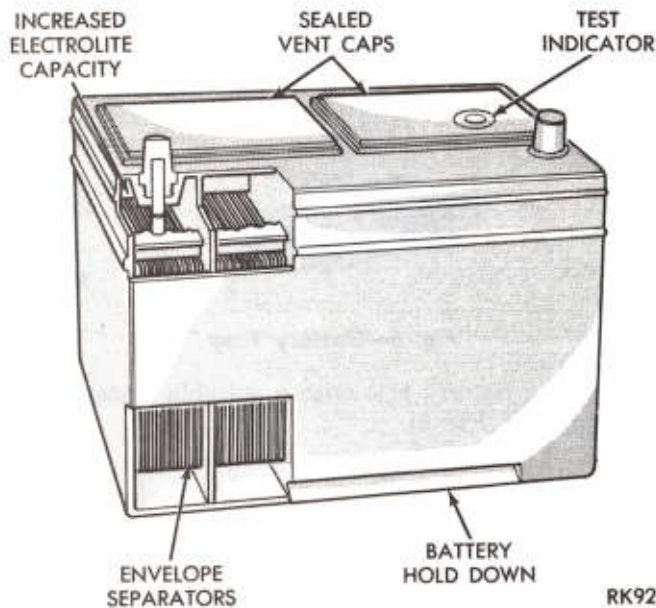
BATTERY SERVICE PROCEDURES

INDEX

General Information	Page 1	Battery Visual Inspection	Page 1
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GENERAL INFORMATION

This section will cover the Battery service, removal, and installation procedures only. For diagnostic procedures, see Group 8A, "Battery/Starter/Charging Systems Diagnostics."



RK92

Fig. 1—Maintenance Free Battery

A battery is the heart of a vehicle's electrical system (Fig. 1). It functions in three ways, first it supplies electrical energy to the starter motor and ignition system while engine is starting, it also acts as power supply to operate lamps, radio, and accessories with engine off. Second it intermittently supplies energy for electrical loads when engine is running and load demands are more than output of alternator. Third it acts as a voltage stabilizer in the electrical system. The battery smooths out temporarily high voltages that would otherwise damage electrical system parts. To do this the battery converts chemical energy into electrical energy by a chemical reaction.

If a battery is not up to specifications it will not

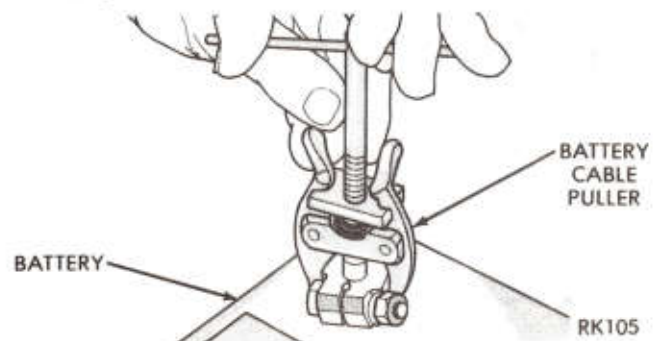
deliver necessary electricity, will not accept electricity and will not act as a capacitor. Consequently, vehicle's entire electrical system will be effected when this happens.

All vehicles are equipped with maintenance free batteries (see Specifications for application). Maintenance-free batteries (Fig. 1) are as the name implies, totally maintenance free and has no removable battery cell caps. Water never needs to be added to the maintenance-free battery. Battery is completely sealed, except for small vent holes in the cover. These vent holes allow what small amount of gasses are produced in the battery to escape. Special chemical composition inside of battery reduces production of gas to an extremely small amount at normal charging voltages. The battery contains a visual test indicator which signals when an adequate charge level exists (green indicator), when charging is required (red or black indicator), or when replacement is required (yellow, indicator). Batteries are now of a lower profile to insure hood clearance on certain models. A proper group size battery must be used when replacing batteries in certain vehicles.

BATTERY VISUAL INSPECTION AND SERVICE

(1) Make sure ignition switch is on OFF position and all battery feed accessories are OFF.

(2) Disconnect battery cables at battery Negative first (Fig. 2).



RK105

Fig. 2—Disconnect Battery Cables

WARNING: CARE SHOULD BE TAKEN, IN THE EVENT BATTERY CASE IS CRACKED OR LEAKING. TO PROTECT HANDS FROM ELECTROLYTE, A SUITABLE PAIR OF RUBBER GLOVES (NOT THE HOUSEHOLD TYPE) SHOULD BE WORN WHEN REMOVING BATTERY BY HAND.

(3) Remove battery hold down (Fig. 3) and remove battery from vehicle.

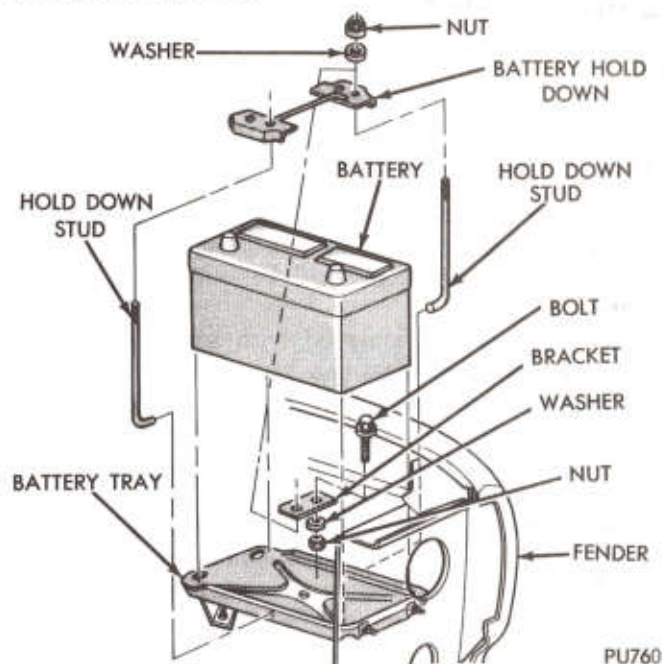


Fig. 3—Battery Hold-Down

(4) Clean top of battery with a solution of clean warm water and baking soda. Scrub area with a stiff bristle brush and wipe off with a cloth moistened with ammonia or baking soda in water (Fig. 4).

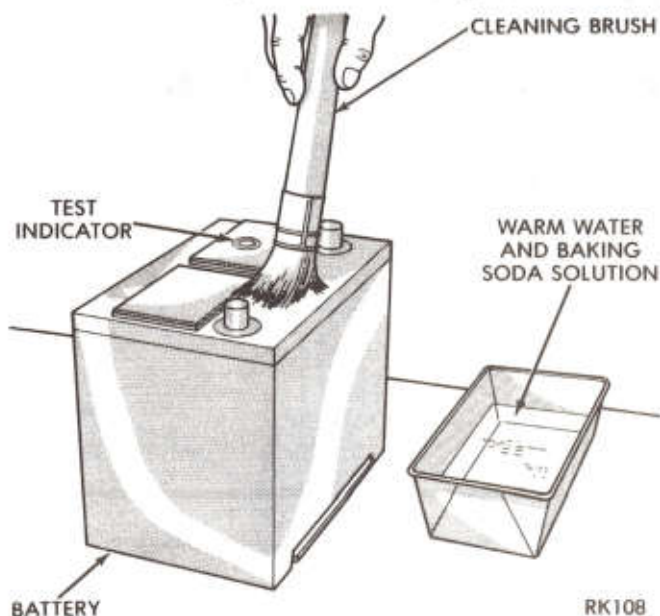


Fig. 4—Cleaning Battery

CAUTION: Care should be taken to insure that solution does not enter vent holes.

(5) Inspect battery case and cover for cracks or leakage. If cracks or leakage is present battery must be replaced.

(6) Inspect battery tray for damage caused by loss of acid from battery. If acid damage is present it will be necessary to clean area with same solution described in Step (4) (Fig. 5).

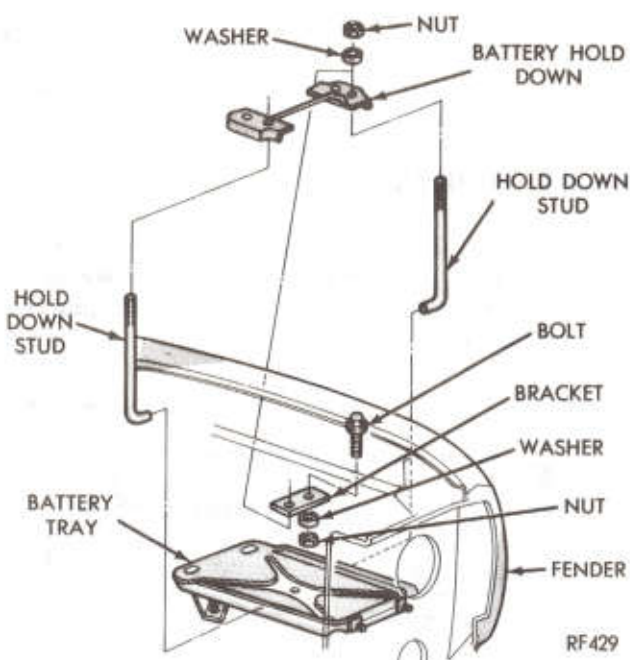


Fig. 5—Battery Tray

(7) Clean battery post with a suitable battery post cleaning tool (Fig. 6).

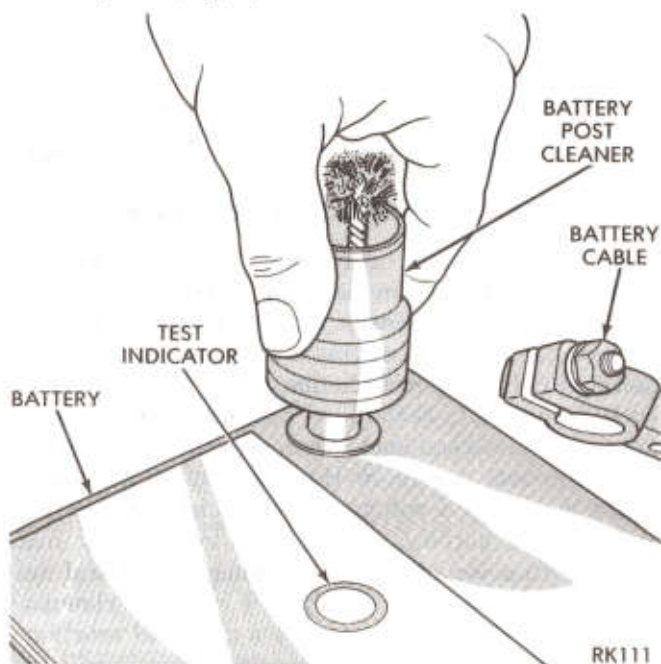


Fig. 6—Cleaning Battery Post

(8) Clean inside surfaces of terminal clamps with a suitable battery terminal cleaning tool (Fig. 7). Replace damaged or frayed cables and broken terminal clamps.

(9) Inspect battery for proper or damaged hold down ledge.

(10) Install battery in vehicle making sure that battery is properly positioned on battery tray (Fig. 3).

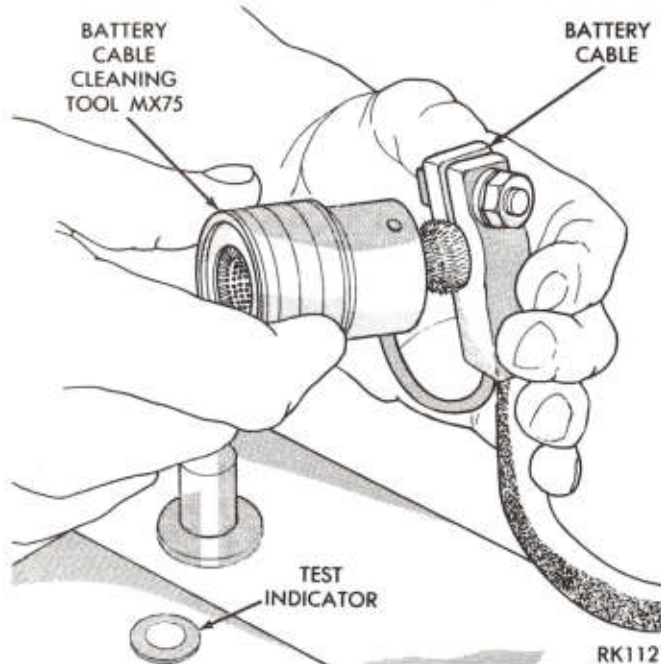


Fig. 7—Cleaning Battery Cable Terminal

(11) Install battery hold down clamp, making sure that it is properly positioned on battery, and tighten bolt to 12 N·m (100 in. lbs.)

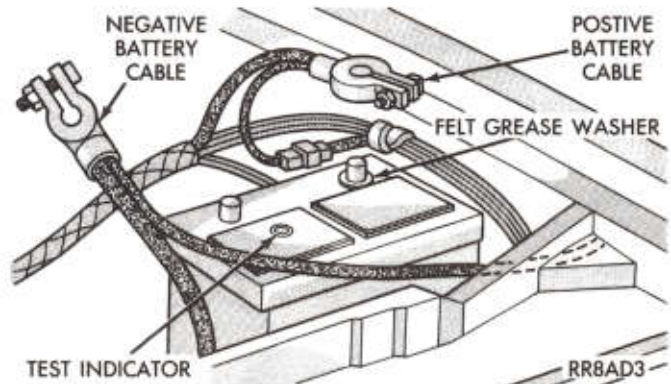


Fig. 8—Battery Cables Disconnected

(12) Place felt grease washer onto Positive (+) battery post.

(13) Connect cable clamps to battery post making sure top of clamp is flush with top of post (Fig. 8).

(14) Tighten clamp nut securely.

STARTER SERVICE PROCEDURES

INDEX

	Page		Page
General Information	3	Starter Motor Removal and Installation	4
Service Procedures Off-Vehicle	5	Test Starter Components (Typical)	8

GENERAL INFORMATION

This section will cover the Starter removal, installation, and off-vehicle testing only. For diagnostic procedures, see Group 8A, "Battery/Starting/Charging Systems Diagnostics."

Starting System Description

Starting system circuits consists of a battery, starter motor, starter relay switch, solenoid, switch, ignition switch, connecting wires and battery cables.

In starting system circuits turning ignition switch to start position closes starter relay points allowing current to energize starter solenoid windings, this

causes solenoid plunger and clutch shift lever to move engaging clutch pinion gear into ring gear, and also at this time closing solenoid contacts causing starter motor to crank. As soon as engine starts running clutch pinion gear overruns to protect starter armature from damage due to excessive speed. Once engine starts running ignition key switch should be immediately returned to run position to prevent excessive starter motor damage.

WARNING: ALWAYS DISCONNECT THE NEGATIVE BATTERY CABLE BEFORE SERVICING THE STARTER.

STARTER MOTOR REMOVAL AND INSTALLATION

- (1) Disconnect negative battery cable (Fig. 1).
 - (2) Remove wire terminal connector from the starter motor (Fig. 2).
 - (3) Remove mounting bolt and nut securing the starter to the bellhousing (Fig. 3).
 - (4) Move the starter forward to clear lower mounting stud and starter gear housing nose and allow the starter to come down past the exhaust pipe (Fig. 4).
- To install, reverse the preceding operation.

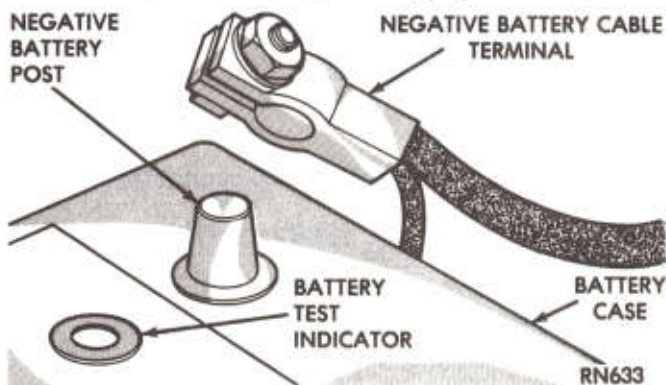


Fig. 1—Remove or Install Battery Cable

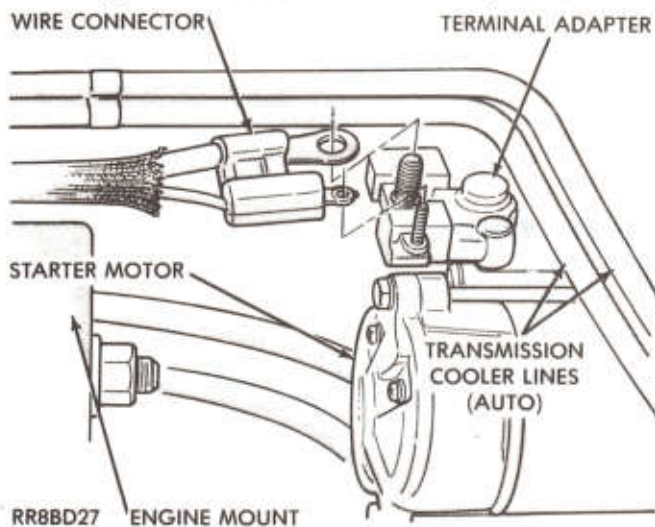


Fig. 2—Remove or Install Starter Wire Connector

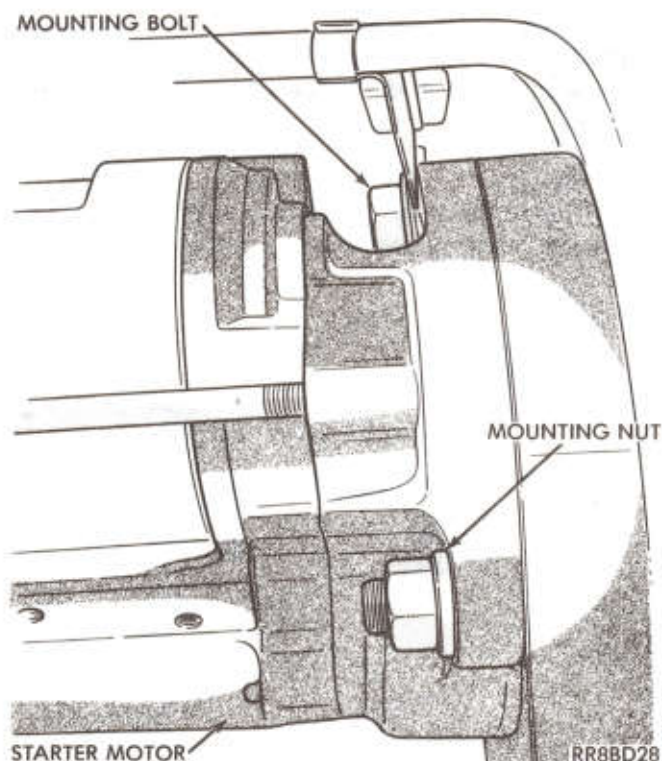


Fig. 3—Remove or Install Starter Mounting Bolt and Nut

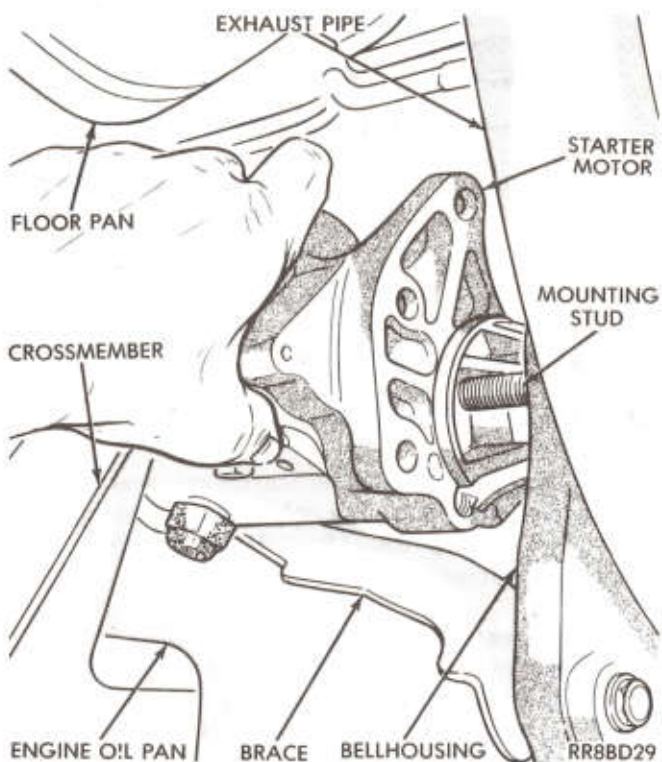
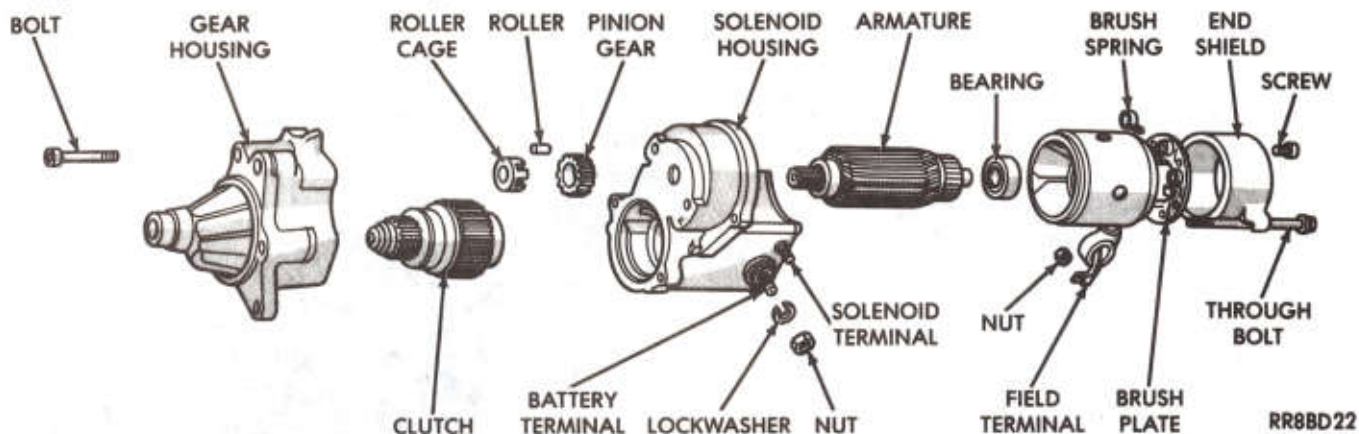
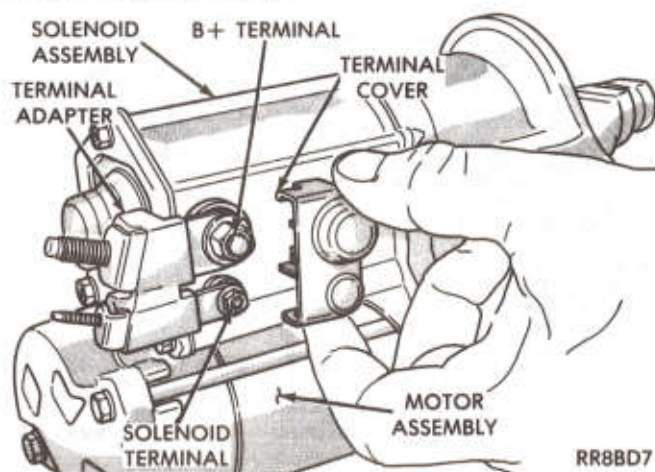
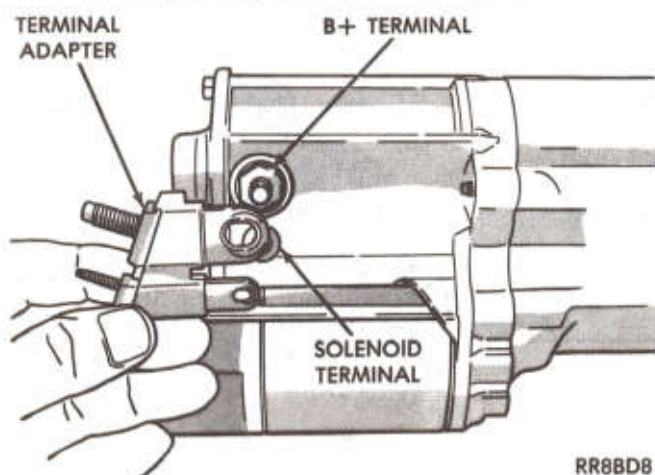


Fig. 4—Remove or Install Starter Motor

SERVICE PROCEDURES OFF-VEHICLE

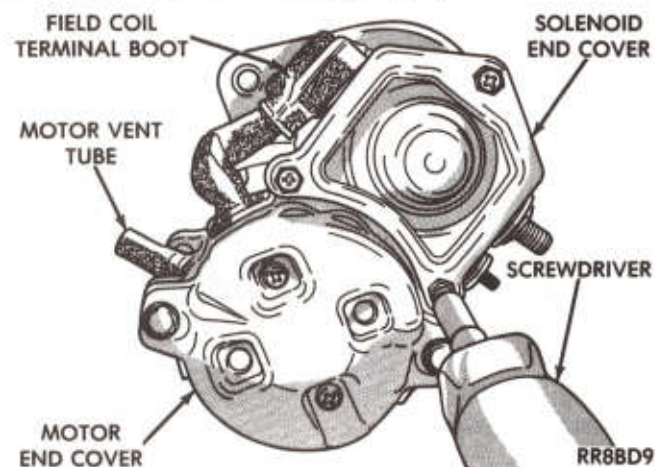
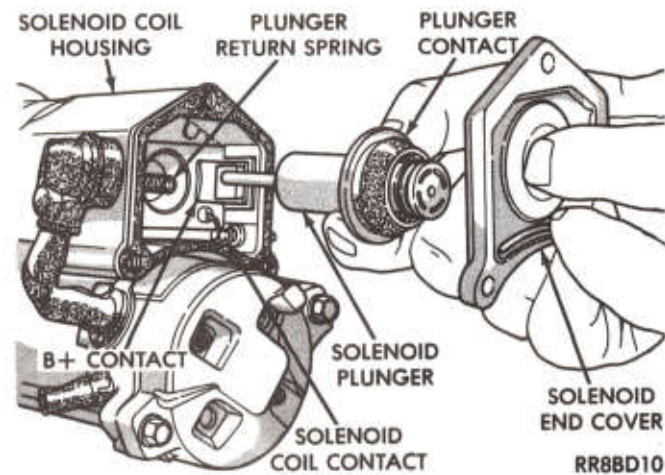
Nippondenso Starter Motor (Fig. 1)**Fig. 1—Nippondenso Starter Motor Assembly****To Overhaul**

(1) Place starter motor on a suitable work surface and remove the heat shields (if so equipped) and wire terminal cover (Fig. 2).

**Fig. 2—Remove or Install Cover****Fig. 3—Remove or Install Terminal Adapter**

(2) Remove terminal adapter attaching (2) nuts and remove adapter terminals (Fig. 3).

(3) Remove solenoid end cover screws, separate end cover from solenoid housing (Fig. 4).

**4—Remove or Install Solenoid End Cover****Fig. 5—Remove or Install Solenoid Plunger**

(4) Pull the solenoid plunger from the solenoid assembly and inspect contact and sliding surfaces for excessive wear (Fig. 5).

(5) Lift field coil terminal boot and remove field terminal attaching (1) nut. Remove drive motor at-

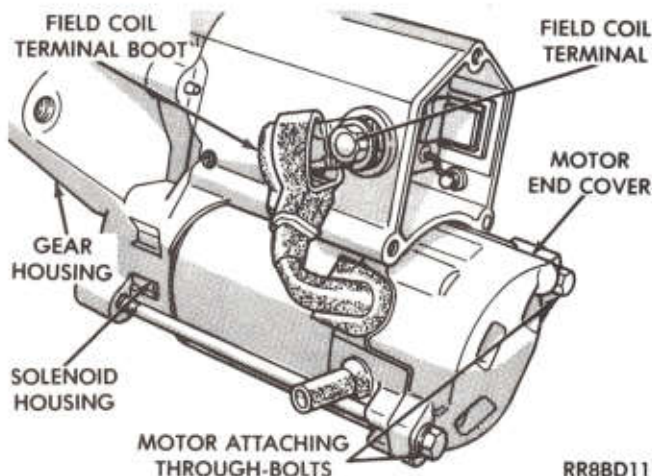


Fig. 6—Remove or Install Field Terminal and Through-Bolts

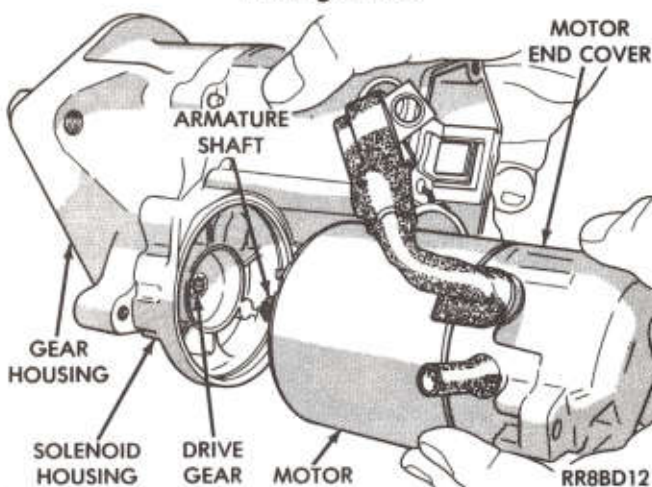


Fig. 7—Remove or Install Motor Assembly

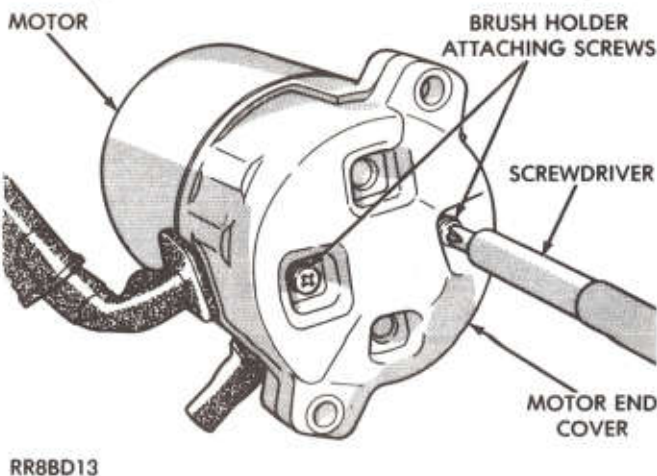


Fig. 8—Remove or Install Motor End Cover Screws

taching (2) through-bolts (Fig. 6).

(6) Disconnect the field terminal lead and disengage the motor from the solenoid and gear housing (Fig. 7).

(7) Remove brush holder attaching (2) screws from the motor end cover (Fig. 8).

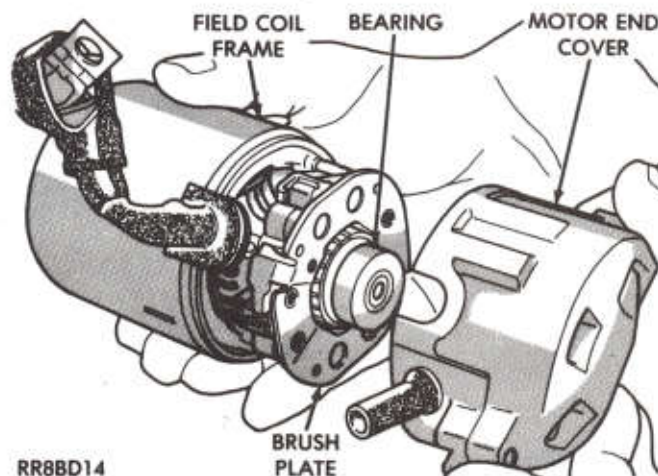


Fig. 9—Remove or Install Motor End Cover

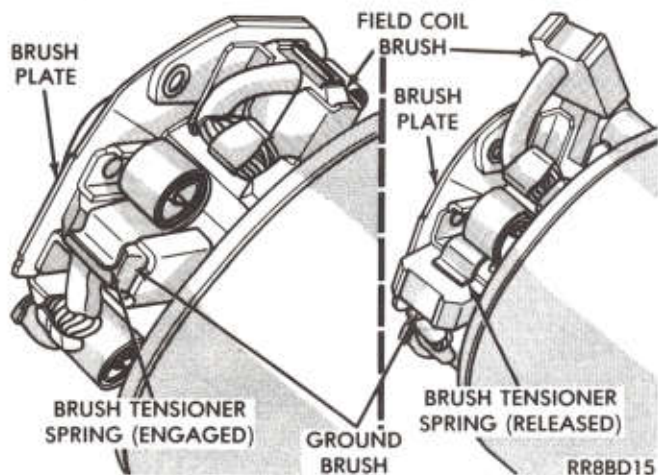


Fig. 10—Remove or Install Field and Ground Brushes

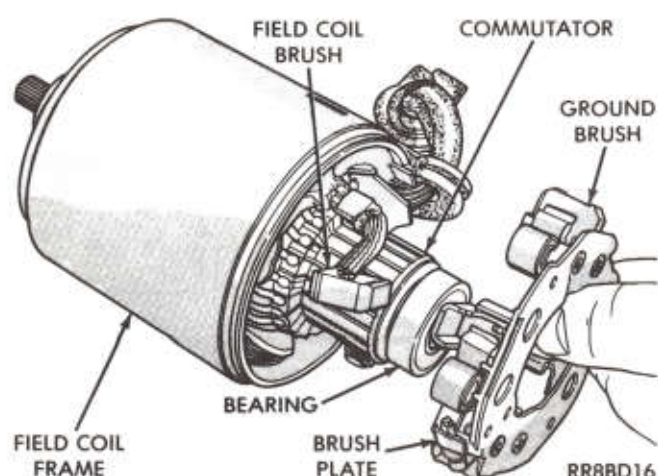


Fig. 11—Remove or Install Brush Plate

CAUTION: Do not damage brush leads while performing step 8.

(8) Remove the motor end cover from the commutator bearing by holding the drive end of the commutator and pulling straight out on the end cover (Fig. 9).

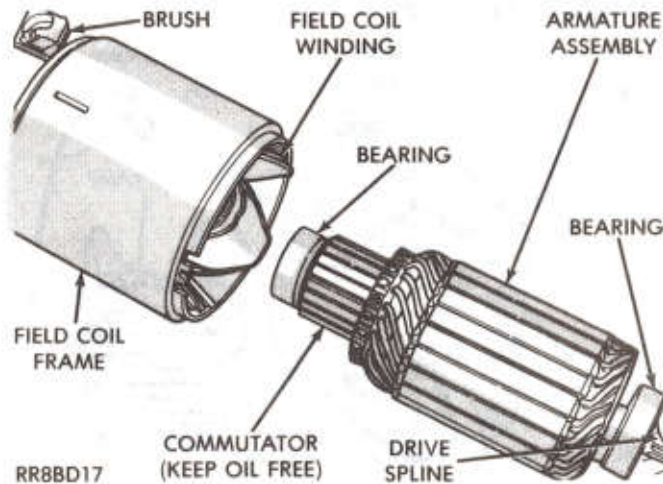


Fig. 12—Remove or Install Armature Assembly

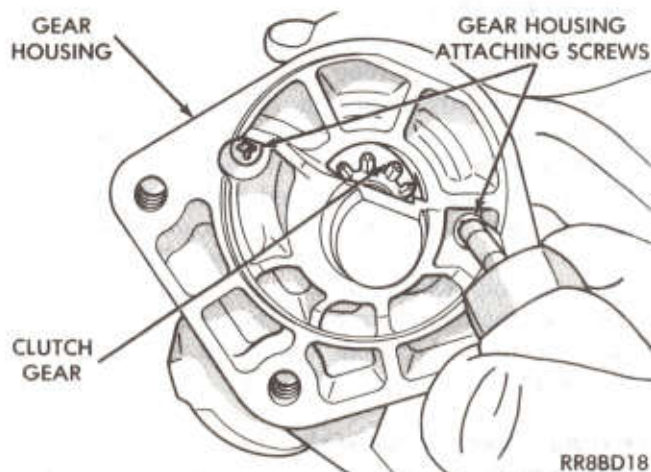


Fig. 13—Remove or Install Gear Housing (Typical)

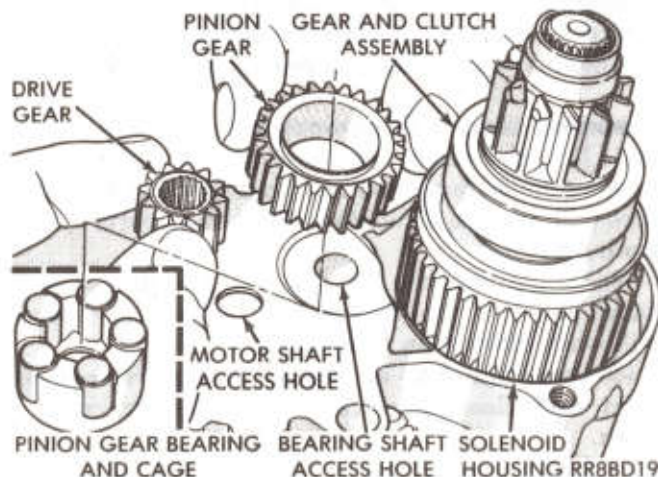


Fig. 14—Remove or Install Drive and Pinion Gears

(9) Slide brush tensioner springs to the side and remove brushes from brush plate (Fig. 10)

(10) Remove the brush plate from the motor assembly (Fig. 11).

(11) Remove the armature assembly from the motor field coil frame by pulling on the armature from the drive end (Fig. 12).

(12) Remove the gear housing attaching (2) screws and separate the gear housing from the solenoid housing (Fig. 13). The pinion gear, pinion gear bearing, and drive gear will be loose between the solenoid housing and the gear housing (Fig. 14). When reinstalling pinion gear and bearing, wipe with a clean rag and coat with lightweight high temperature wheel bearing grease. Place the lubricated bearing and gear over bearing shaft in the gear housing (Fig. 15).

(13) Remove the starter gear and clutch assembly from the solenoid housing (Fig. 16).

To reassemble, reverse the preceding operation.

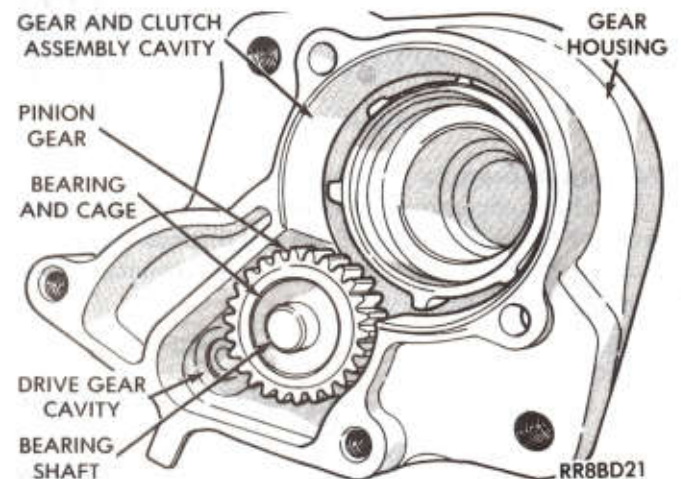


Fig. 15—Lubricate and Install Pinion Gear Bearing

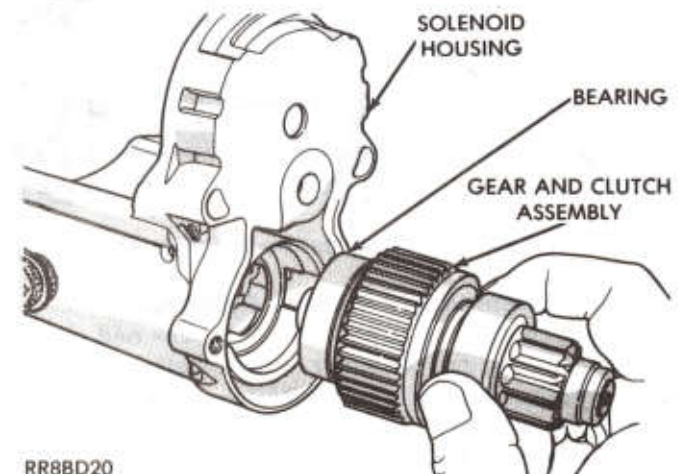


Fig. 16—Remove or Install Gear and Clutch Assembly

TESTING STARTER COMPONENTS (TYPICAL)

Testing Armature for Short Circuit

Place armature in a growler (Fig. 1). Hold a thin steel blade parallel and just above while rotating armature slowly in growler. A shorted armature will cause blade to vibrate and be attracted to core. Replace shorted armature.

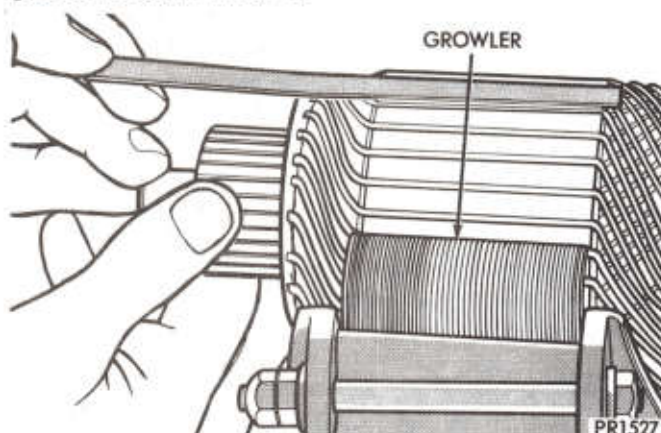


Fig. 1—Testing Armature for Short

Testing Armature for Ground

Touching armature coil core and end of each commutator bar with a pair of test lamp prods (Fig. 2). If lamp lights, it indicates a grounded armature. Replace grounded armature.

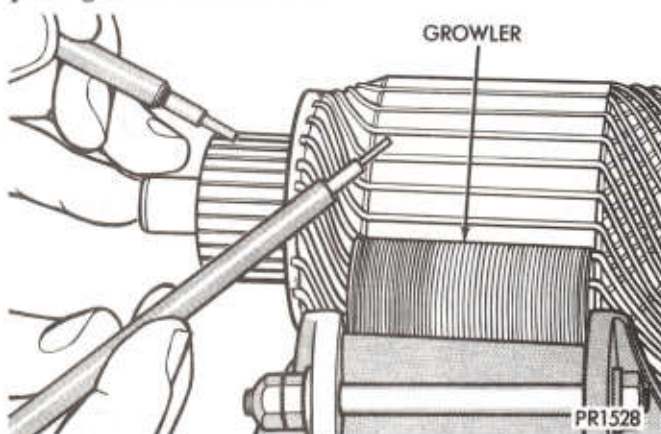


Fig. 2—Testing Armature for Ground

Testing Commutator Runout, Refacing

Place armature in a pair of "V" blocks and check runout with a dial indicator. Check both shaft and commutator. A bent shaft requires replacement of armature.

When commutator runout exceeds 0.076mm (.003 inch), a commutator should be refaced. Remove only a sufficient amount of metal to provide a smooth, even surface.

Testing Fields

(1) Touch one probe of test lamp to series field lead and other probe to field frame. Lamp should not light (Fig. 3).

If lamp lights, field is grounded. If field is grounded, replace field housing assembly.

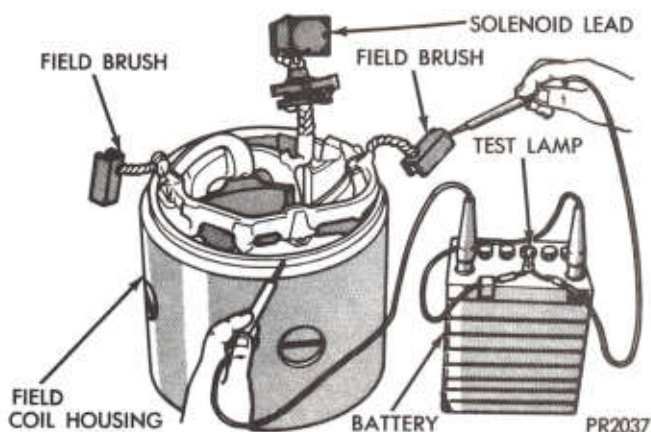


Fig. 3—Testing Fields (Typical)

Testing Brushes

Touch each brush holder with one test probe, while holding other test probe against brush plate. Two brush holders are grounded 180 degrees apart and should cause test lamp to light. The other two brush holders should not cause lamp to light when tested as they are insulated. If insulated brush holders cause lamp to light when tested, it indicates that brush holders on brush plate are grounded. Replace brush plate assembly if brush holders are grounded.

Brushes that are worn more than 1/2 length of new brush, or are oil-soaked, should be replaced. New brushes are 17.5mm (11/16") long.

Testing Drive Clutch Unit

While holding clutch housing, rotate pinion. Drive pinion should rotate smoothly in one direction (not necessarily easily), but should not rotate in opposite direction. If drive unit does not function properly, or if pinion is worn or burred, replace drive unit.

Cleaning Starter Components

(1) Do not immerse parts in cleaning solvent. Immersing field frame and coil assembly and/or armature will damage insulation. Wipe these parts with a cloth **only**.

(2) Do not immerse drive unit in cleaning solvent. Drive clutch is pre-lubricated at factory and solvent will wash lubrication from clutch.

(3) Drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

SPECIFICATIONS

REDUCTION GEAR STARTER		
Manufacturer	Nippondenso	Nippondenso
Engine Application	5.2L & 5.9L	3.9L
Part Number and Power Rating	4379144 1.4 Kw	4379160 1.4 Kw
Voltage	12	12
No. of Fields	4	4
No. of Poles	4	4
Brushes	4	4
Drive	Conventional Gear Train	Conventional Gear Train
Free Running Test		
Voltage	11	11
Amperage Draw	82 Amps	82 Amps
Minimum Speed RPM	3625 RPM	3625 RPM
Solenoid Closing Voltage	7.5 Volts	7.5 Volts
Cranking Amperage Draw Test	150-220 Amps*	150-220 Amps*

*Engine should be up to operating temperature. Extremely heavy oil or tight engine will increase starter amperage draw.

BATTERY SPECIFICATIONS		
Load Test (Amps)	Cold Cranking Rating @ 0°F	Reserve Capacity
200 Amp	400 Amp	100 Minutes
250 Amp	500 Amp	110 Minutes
315 Amp	625 Amp	120 Minutes

CRANKING RATING is the current a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at specified temperature.
RESERVE CAPACITY RATING is the length of time a battery can deliver 25 amps and maintain a minimum terminal voltage of 10.5 volts at 27 °C (80 °F).

ALTERNATOR SERVICE

CONTENTS

	Page		Page
CHRYSLER 90HS, OR 120HS ALTERNATOR	1	NIPPONDENSO 75HS OR 90HS ALTERNATOR	6
		SPECIFICATIONS	13

CHRYSLER 90HS, OR 120HS ALTERNATOR

INDEX

	Page		Page
Alternator Removal and Installation	1	Service Off-Vehicle	2
General Information	1	Testing Off-Vehicle	4

GENERAL INFORMATION

This section will cover off-vehicle alternator service and testing only. Information covering on-vehicle testing can be found in Group 8A, "Battery/Starter/Charging/System Diagnostics."

The standard equipment alternator is the 75HS, or 90HS alternator. When the vehicle is equipped with trailer towing, heavy duty, or snowplow package, a 120HS alternator is used. See Specifications for additional information.

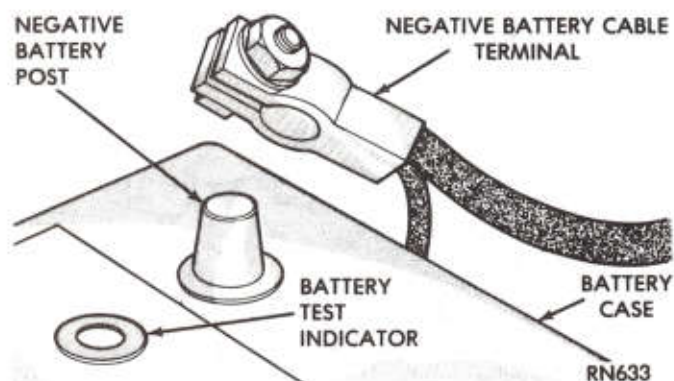


Fig. 1—Remove or Install Battery (—) Cable

ALTERNATOR REMOVAL AND INSTALLATION

- (1) Remove the negative battery cable (Fig. 1).
- (2) Remove alternator drive belt. See Group 7, "Cooling System" for instructions.
- (3) Remove the alternator mounting nut (top) and bolt (bottom) and position the alternator so the wire connectors face the front of the vehicle (Fig. 2). When installing alternator position the spacer between the end shield lower pivot mounts.
- (4) Remove B+ terminal (1) nut, field terminal (2) nuts, ground and harness hold down (2) nuts (Fig. 3). Remove wire connector assembly.

- (5) Remove the alternator from the vehicle. To reinstall, reverse the preceding operation.

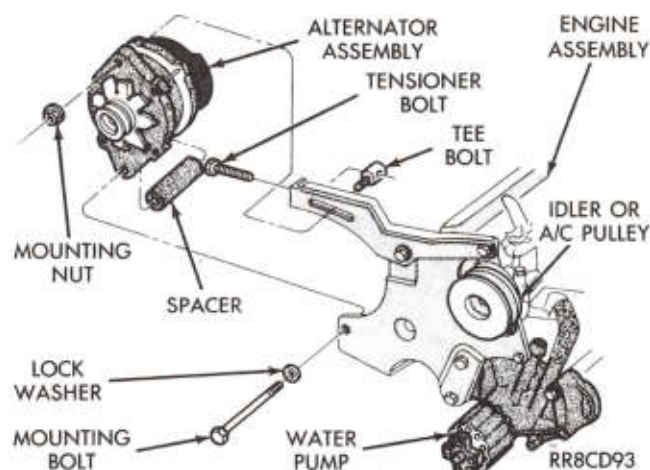


Fig. 2—Remove or Install Alternator Assembly

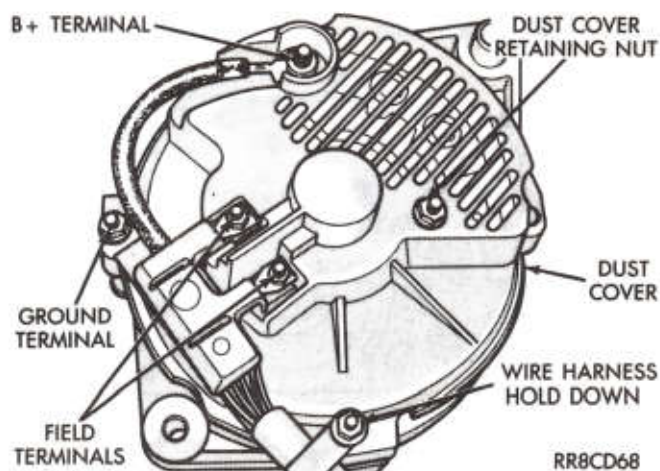
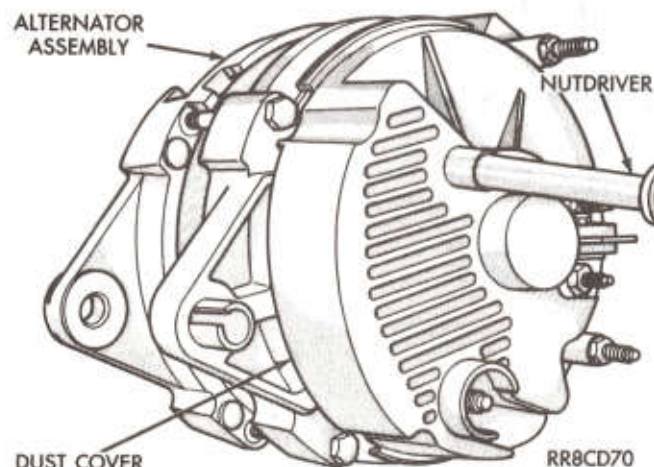
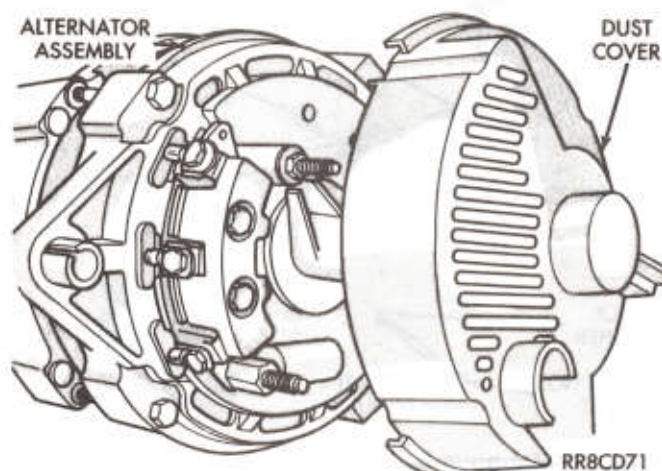
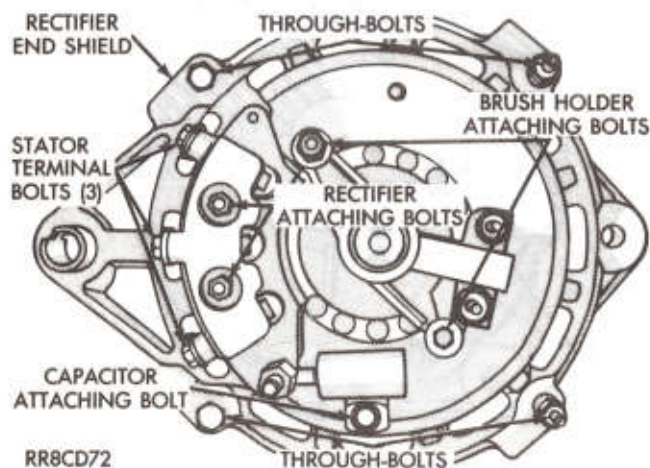


Fig. 3—Remove or Install Wire Connector Assembly

SERVICE OFF-VEHICLE

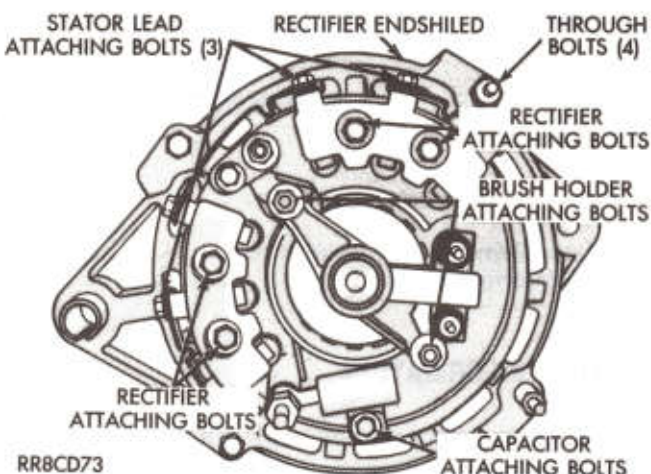
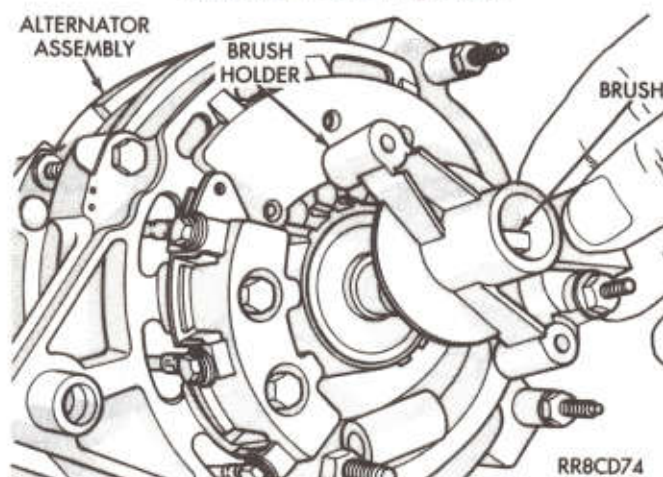
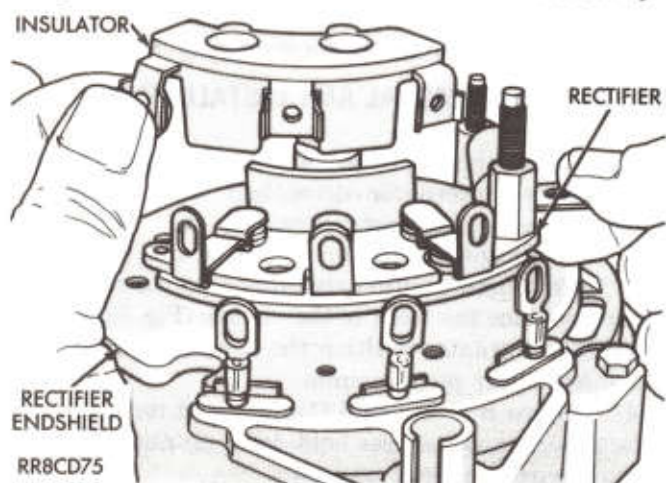
Chrysler 90HS or 120HS Alternators**To Disassemble and Assemble**

- (1) Remove rectifier dust cover nut (Fig. 1).
- (2) Separate cover from the alternator (Fig. 2).

**Fig. 1—Remove or Install Dust Cover Nut****Fig. 2—Remove or Install Dust Cover****Fig. 3—90HS Alternator Rectifier End Shield Assembly Attaching Bolts**

- (3) Remove brush holder attaching (2) bolts (Fig. 3 or 4) and separate the brush holder from the alternator (Fig. 5).

- (4) Remove stator lead, rectifier, and capacitor attaching bolts (Fig. 3 or 4) and separate rectifier and insulator from alternator (Fig. 6 or 7).

**Fig. 4—120HS Alternator Rectifier End Shield Assembly Attaching Bolts****Fig. 5—Remove or Install Brush Holder Assembly****Fig. 6—Remove or Install Rectifier 90HS Alternator**

(5) On 120HS alternator rectifier, remove connecting strap from between rectifiers, remove buss bar and insulator attaching screws and separate the insulators from the rectifier (Fig. 8).

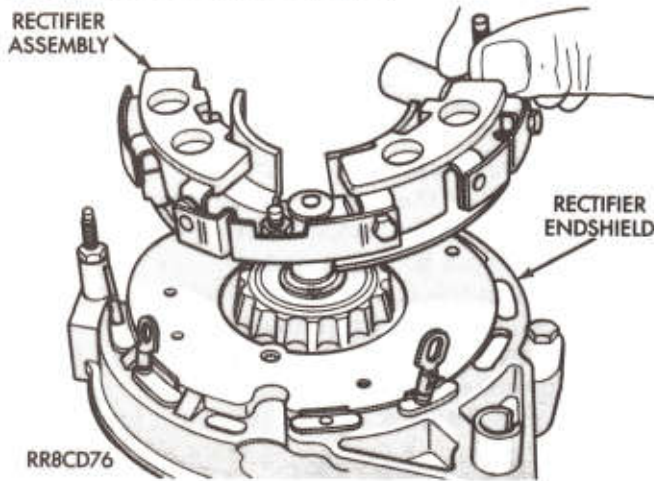


Fig. 7—Remove or Install Rectifiers 120HS Alternator

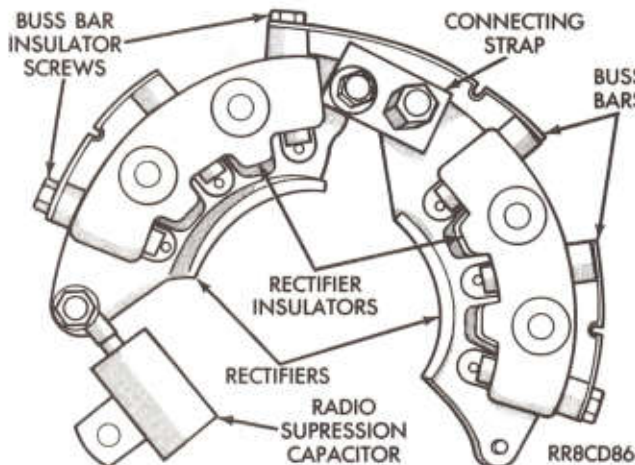


Fig. 8—120HS Alternator Rectifier Assembly

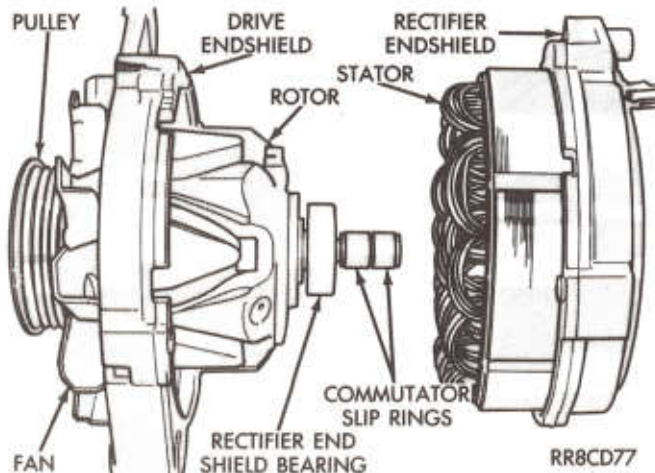


Fig. 9—Separate Stator from Drive End Shield

(6) Remove end shield (4) through-bolts (Fig. 3).
 (7) Separate the stator and rectifier end shield from the drive end shield (Fig. 9).
 (8) Separate stator from the rectifier end shield (Fig. 10).

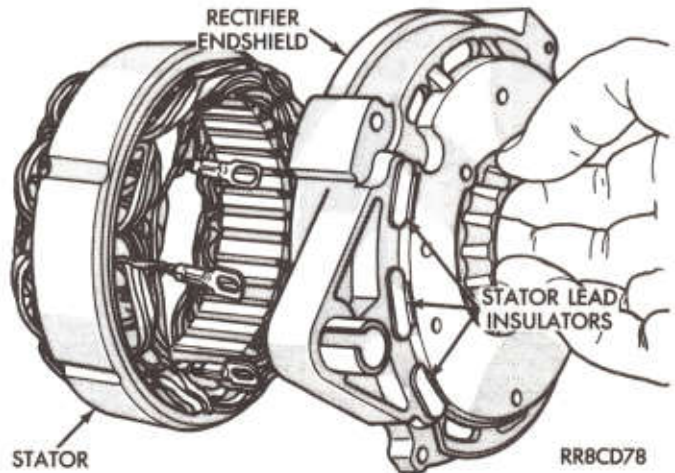


Fig. 10—Separate Stator from End Shield

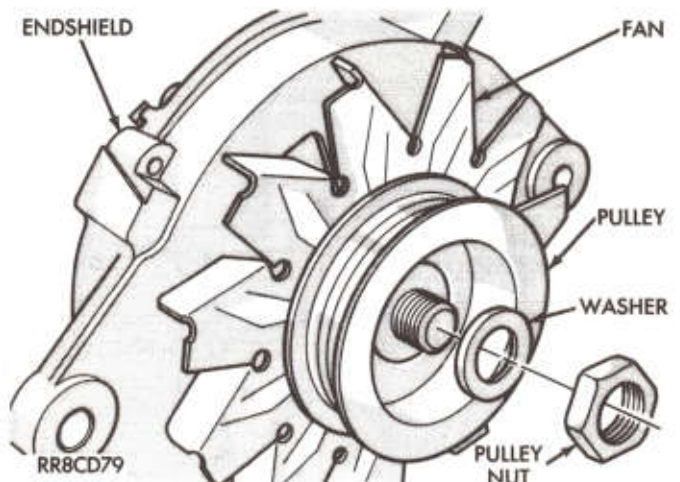


Fig. 11—Remove or Install Pulley Nut and Washer

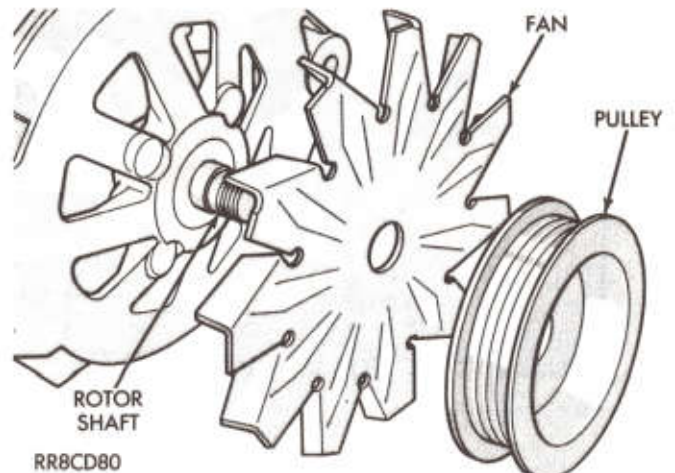


Fig. 12—Remove or Install Pulley and Fan

- (9) Remove drive pulley nut and washer (Fig. 11).
- (10) Remove pulley and fan from rotor (Fig. 12).
- (11) Using a suitable device, press the rotor shaft from the drive end shield (Fig. 13). If the bearing is defective, the drive end shield must be replaced as an assembly.
- (12) Using tool C-4886, remove the rectifier end bearing (Fig. 14). To install the rectifier end bearing,

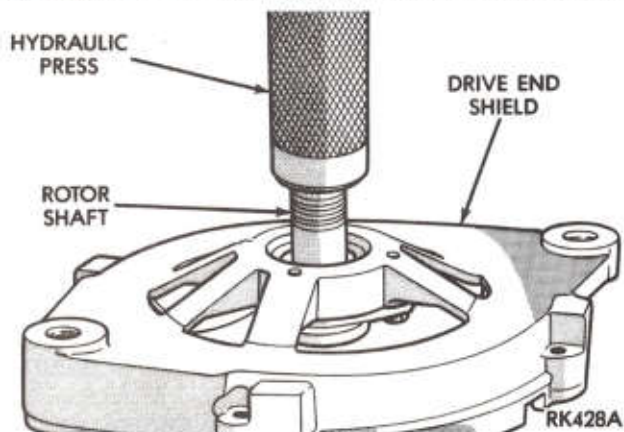


Fig. 13—Press Rotor Shaft from End Shield

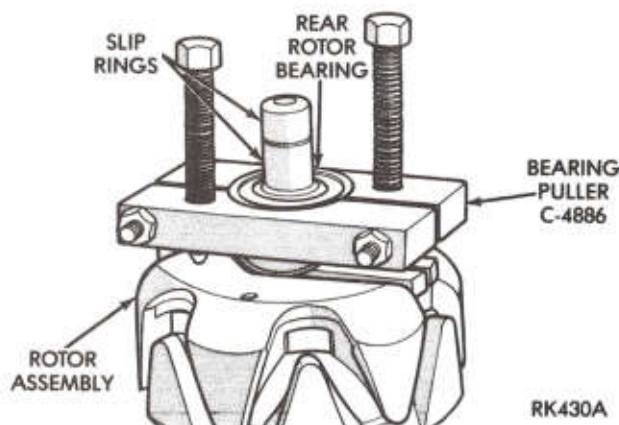


Fig. 14—Remove Rectifier End Bearing

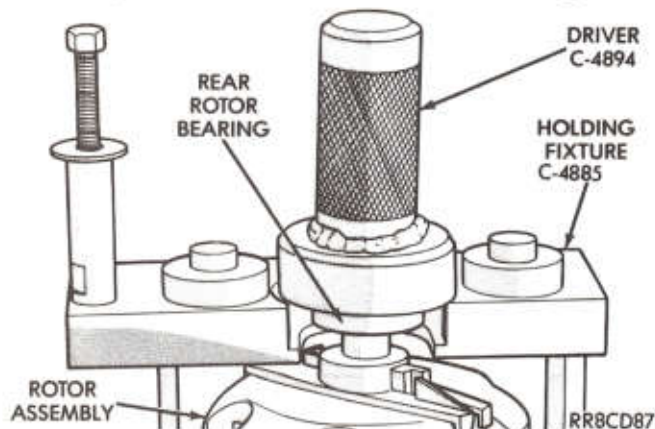


Fig. 15—Install Rectifier End Bearing

position the rotor assembly in C-4885 holding fixture and drive the bearing onto shaft with C-4894 driver (Fig. 15).

To assemble, reverse the preceding operation.

TESTING OFF-VEHICLE

Chrysler 90HS or 120HS Alternator

Brush Holder Tests

- (1) Verify that the brushes move smoothly in and returns fully to the stops when released. If not, replace the brush holder assembly.
 - (2) Using an ohmmeter, test for continuity from the inner brush to the field terminals. One field terminal should be open and the other should be closed (Fig. 1).
 - (3) Repeat step 2 on outer brush (Fig. 2).
- If failure is detected, replace the brush holder.

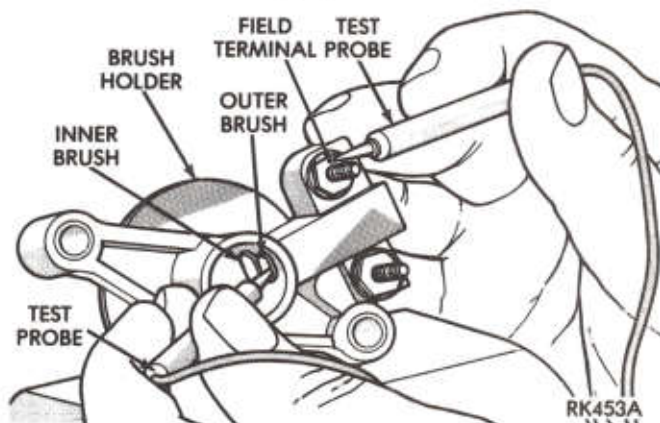


Fig. 1—Test Inner Brush Continuity

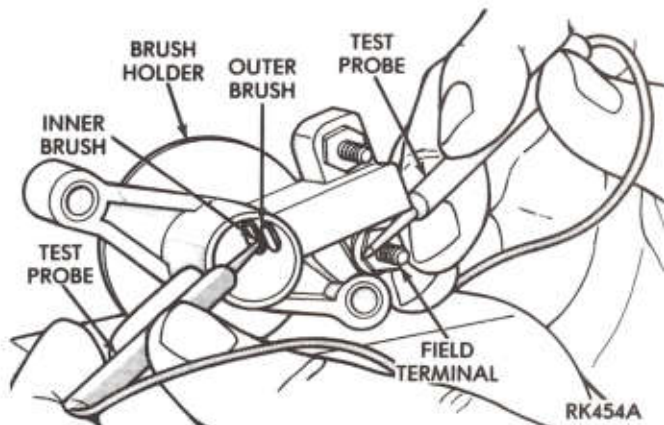


Fig. 2—Test Outer Brush Continuity

Rotor Tests

(1) Inspect the field slip rings for excessive wear or roughness. Minor damage can be dressed out with a fine emery cloth. If the slip rings are too badly damaged, the rotor must be replaced (Fig. 3).

(2) Using an ohmmeter, test for continuity from one slip ring to the other; the circuit should be closed (Fig. 3).

(3) Using an ohmmeter, test for continuity from both of the field coil slip rings to the rotor shaft or core; it should test open (Fig. 3).

If failure is detected, replace the rotor.

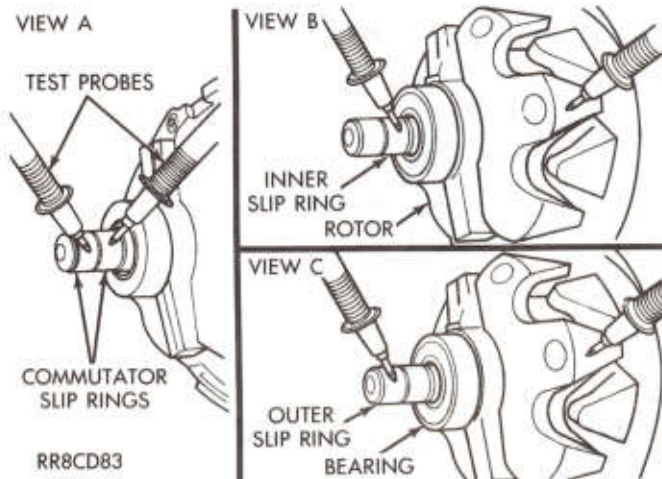


Fig. 3—Test Rotor Continuity

Stator Tests

(1) Inspect the stator for signs of damage (weak or broken leads, distorted frame, or burned windings).

(2) Using a scraping device, clean a small area of the stator frame to assure a good electrical contact.

(3) Using an ohmmeter, test for continuity from the

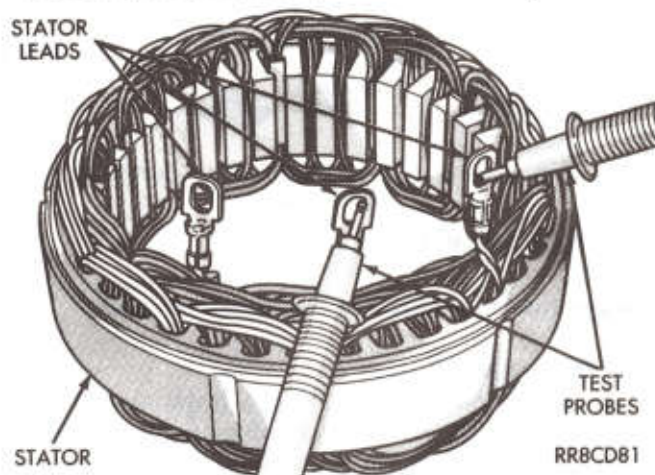


Fig. 4—Stator Coil Circuit

stator leads to the frame; it should test open (Fig. 6).

(4) Test continuity from one stator lead to the other leads; the circuit should be closed (Fig. 7).

If failure is detected, replace the stator.

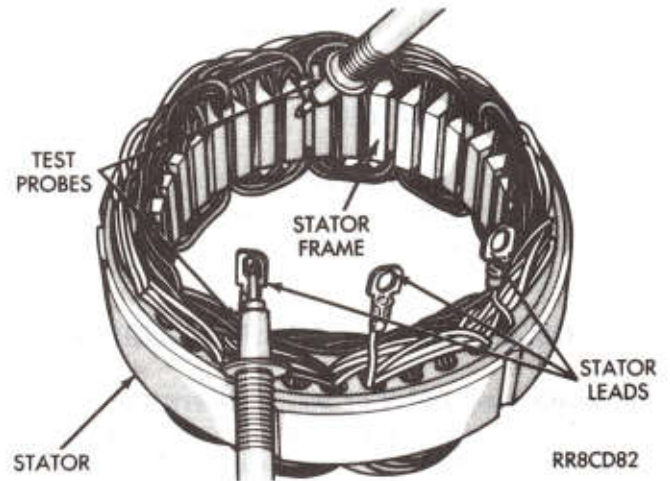


Fig. 5—Test Stator Coil to Frame

Rectifier Tests

(1) Separate the positive diode leads from the negative diode leads.

(2) Using a analog ohmmeter, test for continuity from the positive heat sink to each of the positive diode leads. Then reverse the test probes and repeat the test (Fig. 6). The result should show continuity in one direction only.

(3) Test for continuity from the negative heat sink to each of the negative diode leads. Then reverse the test probes and repeat test (Fig. 6). The result should show continuity in one direction only.

If failure is detected, replace rectifier assembly.

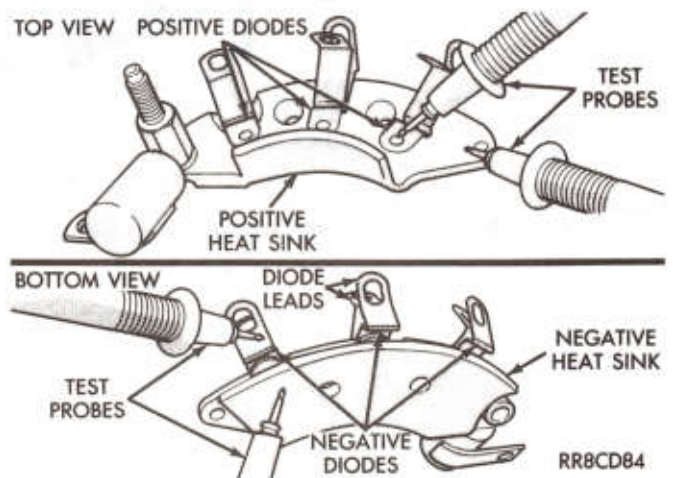


Fig. 6—Rectifier Tests

NIPPONDENSO 75HS OR 90HS ALTERNATOR

INDEX

	Page		Page
Alternator Removal and Installation	6	Service Off-Vehicle	6
General Information	6	Testing Off-Vehicle	10

GENERAL INFORMATION

This section will cover off-vehicle alternator service and testing only. Information covering on-vehicle testing can be found in Group 8A, "Battery/Starter/Charging/Systems Diagnostics."

ALTERNATOR REMOVAL AND INSTALLATION

Nippondenso 75HS or 90HS Alternator

- (1) Remove the negative battery cable (Fig. 1).
 - (2) Remove alternator drive belt. See Group 7, Cooling System.
 - (3) Remove the alternator mounting nut (top) and bolt (bottom) and separate the alternator from the mounting plate (Fig. 2).
 - (4) Remove the B+ terminal (1) nut, field terminal (2) nuts, ground, and harness hold-down (2) nuts (Fig. 3). Remove wire connectors.
 - (5) Remove the alternator from the vehicle.
- To reinstall, reverse the preceding operation.

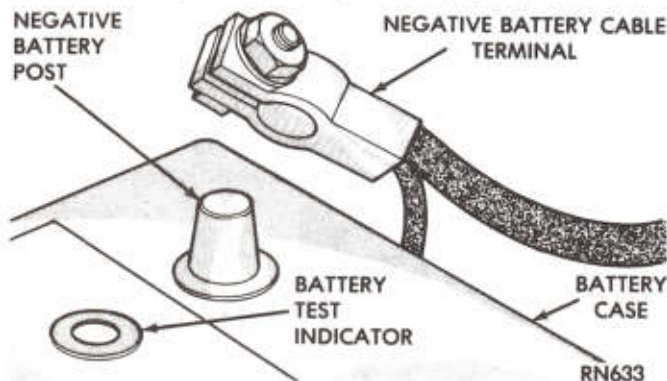


Fig. 1—Remove or Install Battery (–) Cable

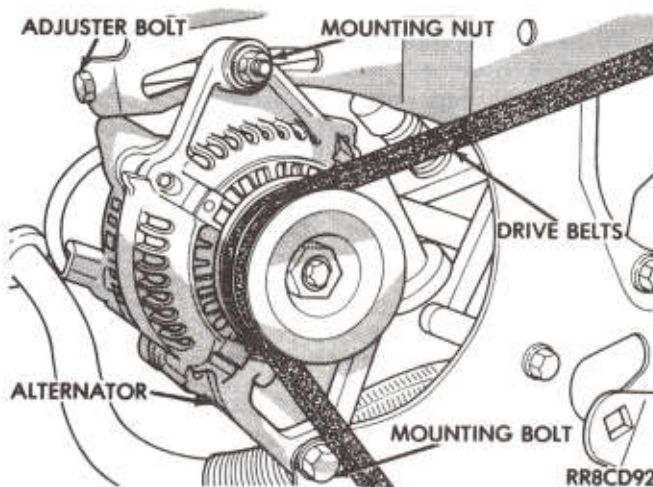


Fig. 2—Remove or Install Mounting Bolts

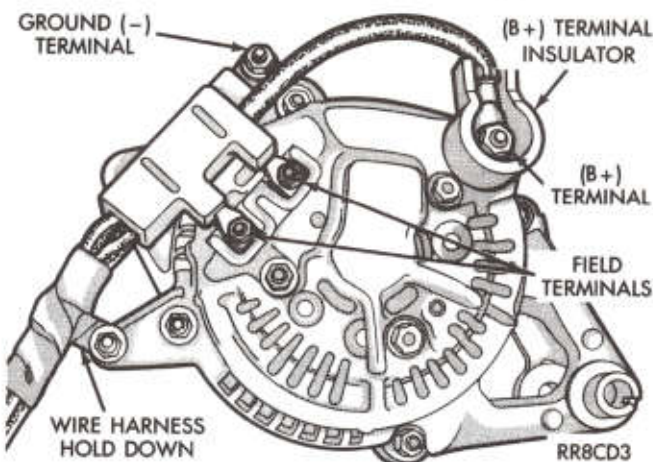


Fig. 3—Remove or Install Wire Connector Assembly

SERVICE OFF-VEHICLE

Nippondenso 75HS or 90HS Alternator**To Disassemble and Assemble**

- (1) Place the alternator on a suitable work surface. Remove the B+ insulator attaching (1) nut and lift off the insulator. Remove rear cover attaching (3) nuts and lift off the rear cover (Fig. 4). When installing the B+ insulator, align the guide boss into the hole in the rear cover.

(2) Remove brush holder attaching (3) screws and lift the brush holder from the alternator (Fig. 5 and 6). When installing the brush holder, hold the brushes into the holder and slide the assembly over the commutator slip rings and screw into place (Fig. 7).

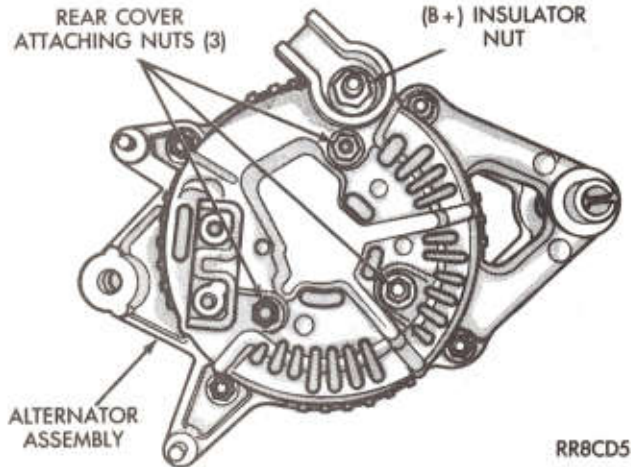


Fig. 4—Remove or Install Rear Cover

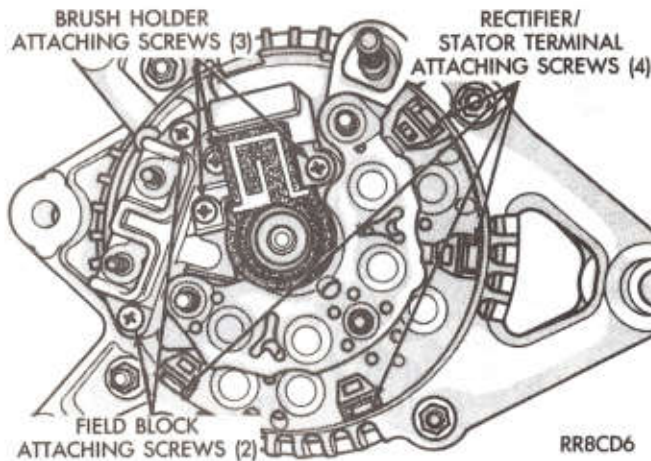


Fig. 5—Remove or Install Attaching Screws

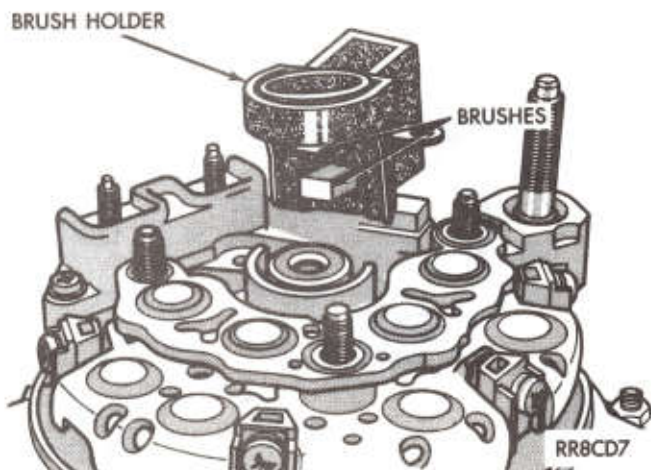


Fig. 6—Remove or Install Brush Holder

(3) Remove field block attaching (2) screws and lift the field block from the alternator (Fig. 8).

(4) Remove the rectifier and stator terminal attaching (4) screws and lift the rectifier from the alternator assembly (Fig. 5 and 9).

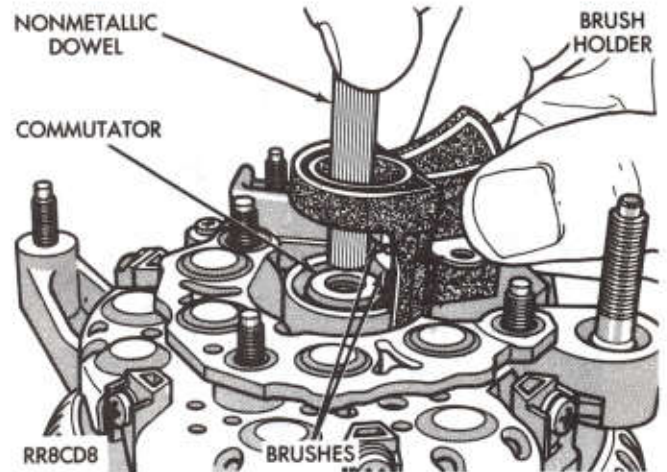


Fig. 7—Push Brushes into Holder and Install

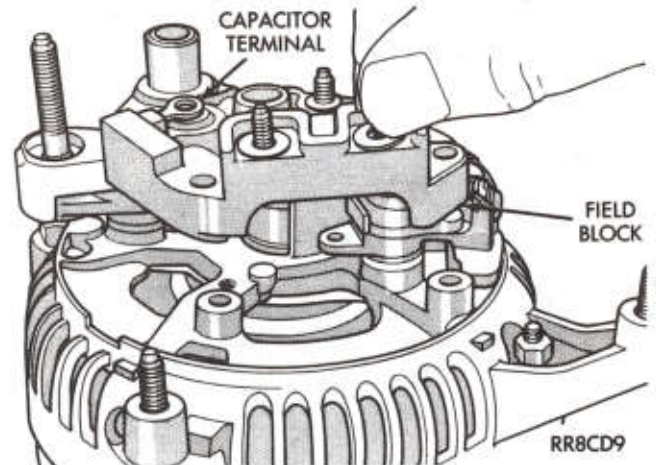


Fig. 8—Remove or Install Field Block

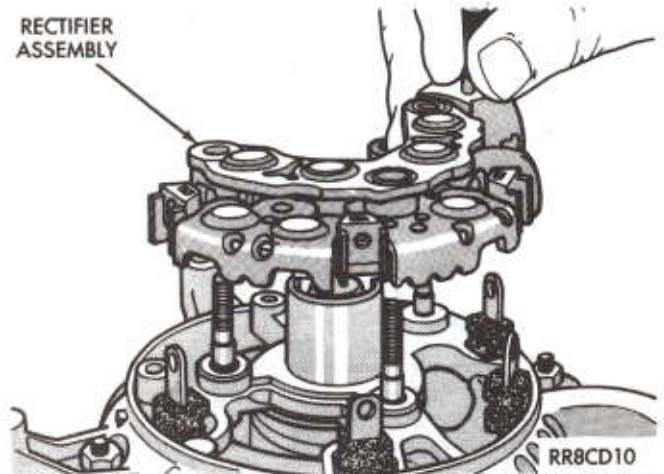


Fig. 9—Remove or Install Rectifier Assembly

(5) Remove stator terminal rubber (4) insulators (Fig. 10).

(6) Remove end shield attaching through-stud (4) nuts (Fig. 11).

(7) With the drive pulley in a downward position, tap upward on the rectifier end shield and separate the two end shields (Fig. 12).

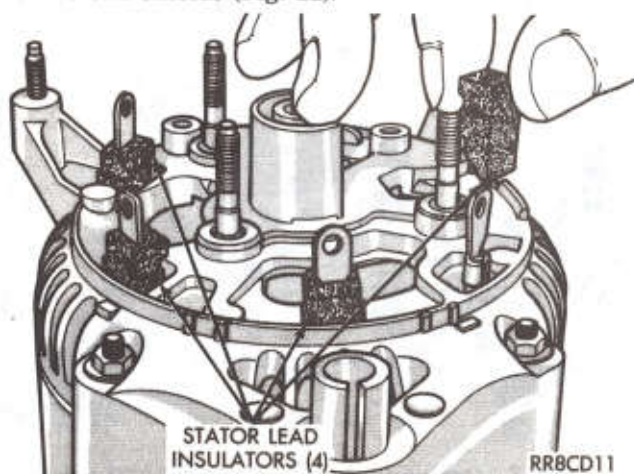


Fig. 10—Remove or Install Insulator

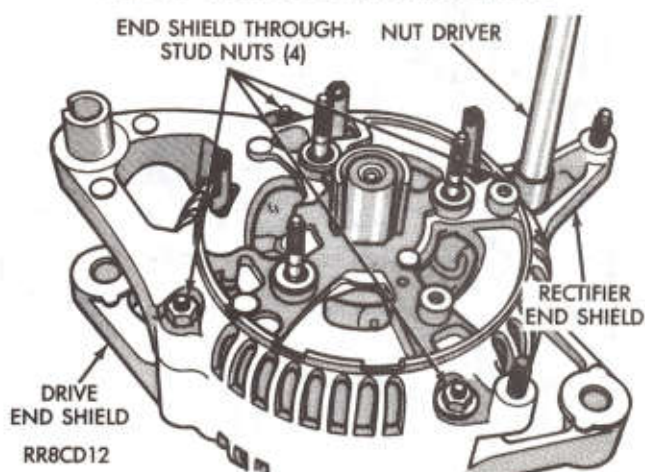


Fig. 11—Remove or Install Through-Stud Nuts

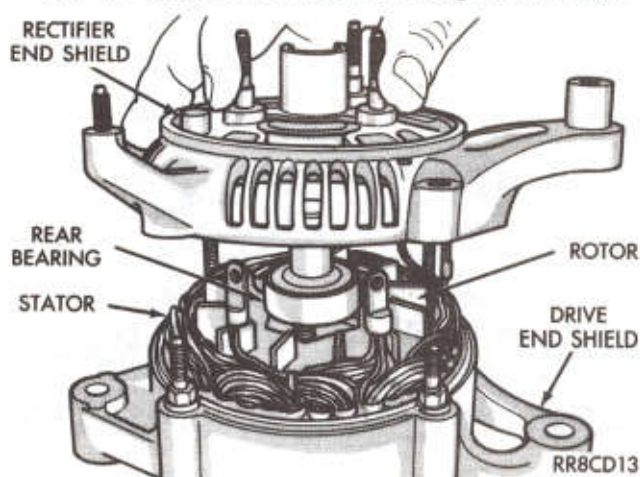


Fig. 12—Separate End Shields

(8) Remove alternator drive pulley attaching (1) nut (Fig. 13).

(9) Remove the drive pulley from the rotor shaft (Fig. 14).

CAUTION: Do not handle the rotor by the commutator slip rings. Hand oil or grease may restrict contact.

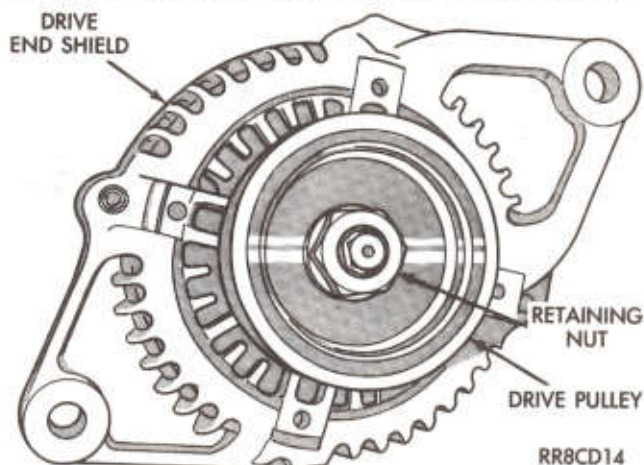


Fig. 13—Remove or Install Drive Pulley Attaching Nut

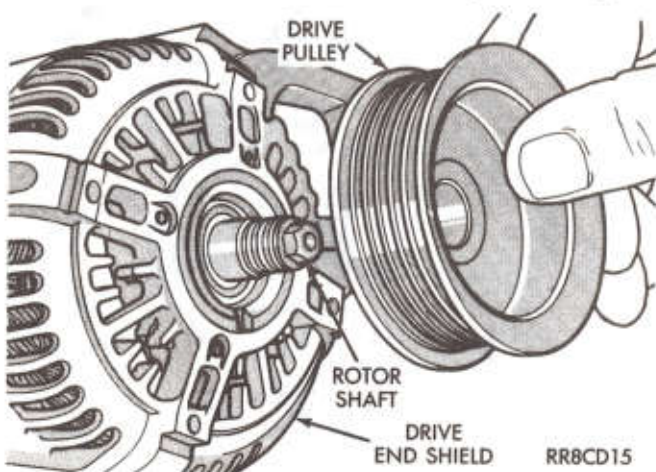


Fig. 14—Remove or Install Drive Pulley

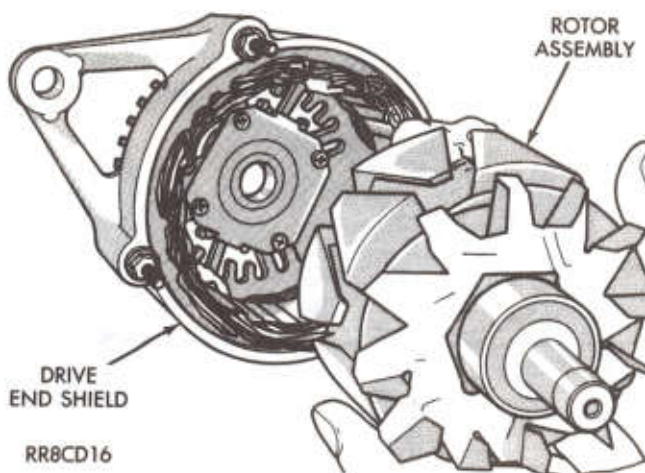


Fig. 15—Remove or Install Rotor Assembly

(10) Pull the rotor assembly from the drive end shield (Fig. 15).

When installing the rotor, clean the commutator slip rings with a suitable solvent and clean cloth (Fig. 16).

(11) With a suitable puller (C-4068 or C-4333), remove the rectifier end shield bearing (Fig. 17).

CAUTION: Do not damage the commutator slip rings when installing the rectifier end shield bearing. Use a suitable press ram adapter and press bearing onto the rotor shaft.

(12) Remove drive end shield bearing retainer (4) attaching screws and remove the retainer (Fig. 18).

(13) With the drive end shield on a suitable work surface, use a socket and light hammer, tap the bearing from the drive end shield (Fig. 19).

When installing the bearing, use a socket slightly smaller than the bearing and tap the bearing into the drive end shield (Fig. 20).

To reassemble, reverse the preceding operation.

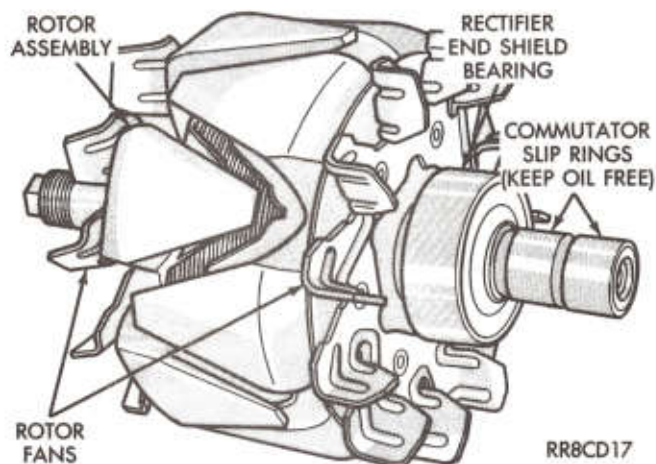


Fig. 16—Alternator Rotor Assembly

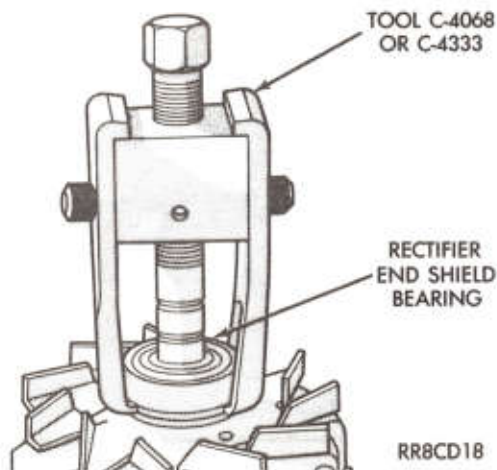


Fig. 17—Remove Rectifier End Shield Bearing

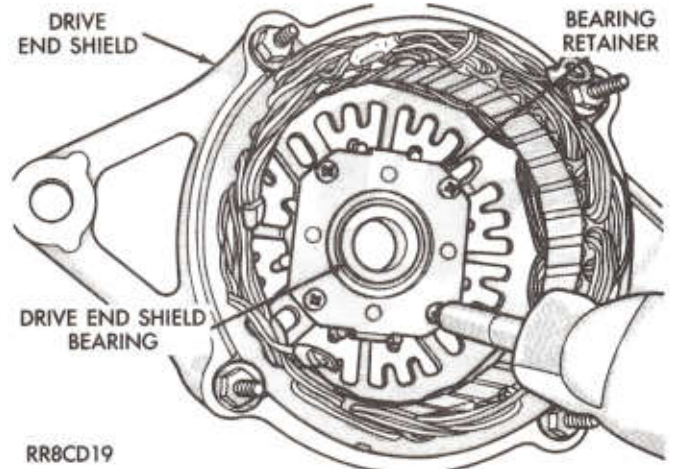


Fig. 18—Remove or Install Drive End Shield Bearing Retainer

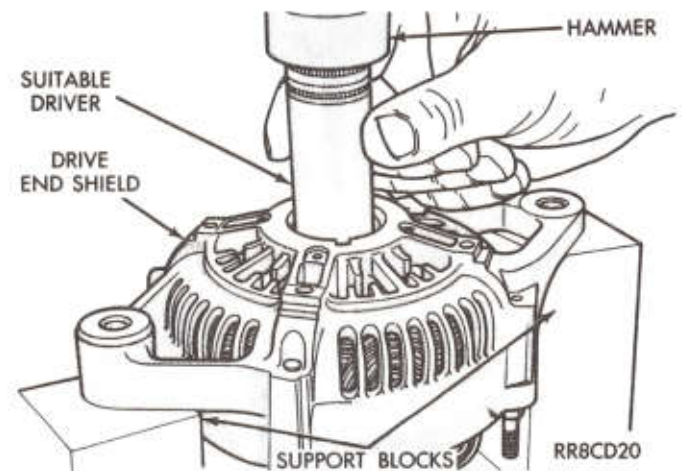


Fig. 19—Remove Drive End Shield Bearing

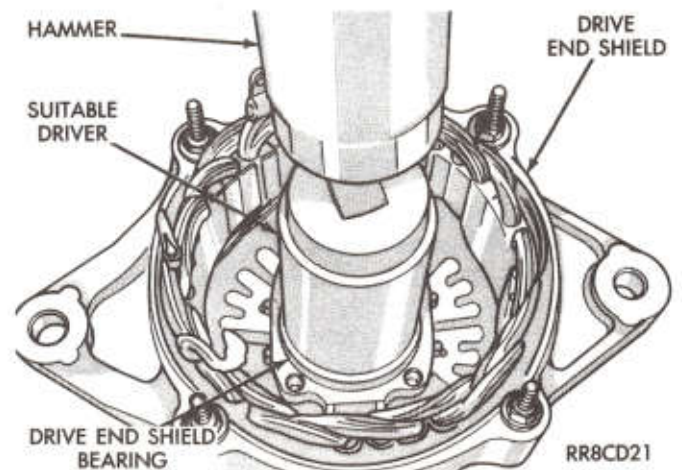


Fig. 20—Install Drive End Shield Bearing

TESTING OFF-VEHICLE

Nippondenso 75HS or 90HS Alternator**Brush Holder Tests**

(1) Verify that the brushes move smoothly in and returns fully to the stops when released. If not, replace the brush holder assembly.

(2) Using an ohmmeter, test for continuity from the inner brush to the field block terminals. One should be open and the other should be closed (Fig. 1).

(3) Repeat step 2 on the outer brush (Fig. 2).

If failure is detected, replace the brush holder.

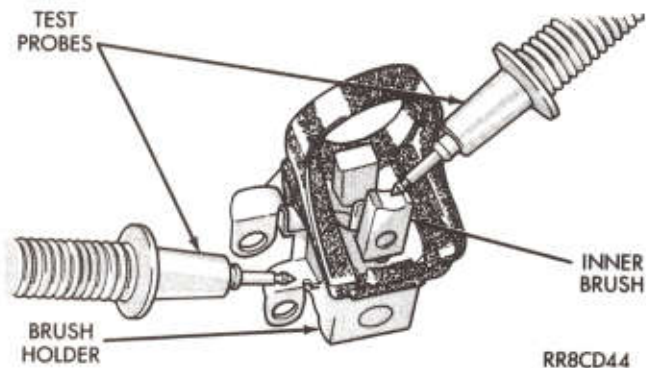


Fig. 1—Test Inner Brush Continuity

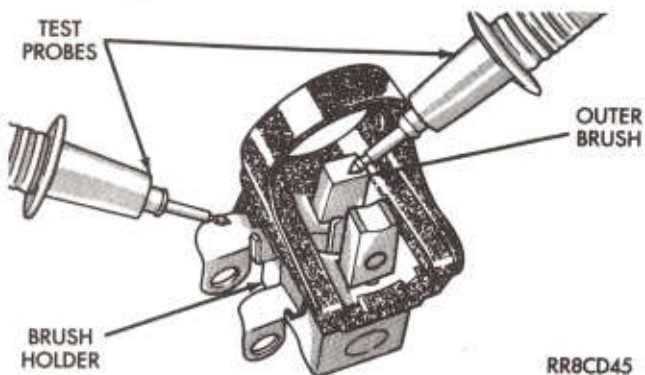


Fig. 2—Test Outer Brush Continuity

Field Block Tests

(1) Using an ohmmeter, test for continuity from the outer brush terminal to the R-3 field terminal; the circuit should be closed (Fig. 3).

(2) Test for continuity from the inner brush terminal to the J-2 field terminal; the circuit should be closed (Fig. 4).

(3) Test for continuity from the J-2 field terminal to the R-3 terminal; it should test open (Fig. 5).

(4) Turn the field block over and test for continuity across the radio suppression capacitor terminals; it should test open (Fig. 6).

If failure is detected, replace field block.

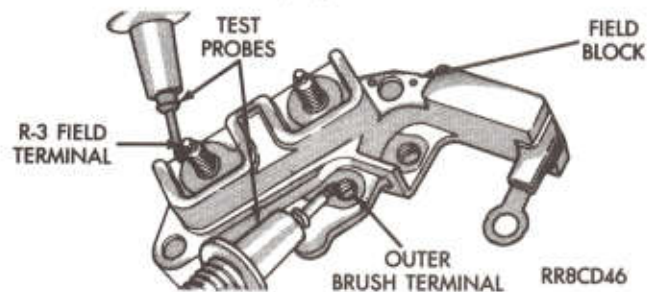


Fig. 3—Test Field Block R-3 Terminal

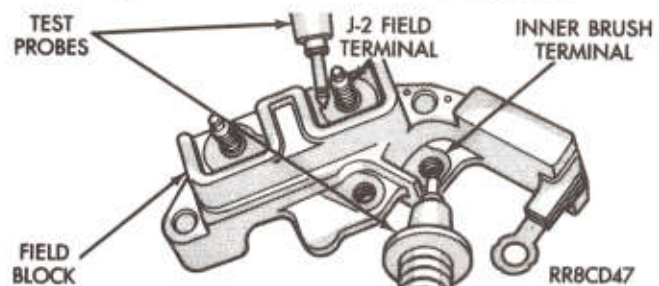


Fig. 4—Test Field Block J-2 Terminal

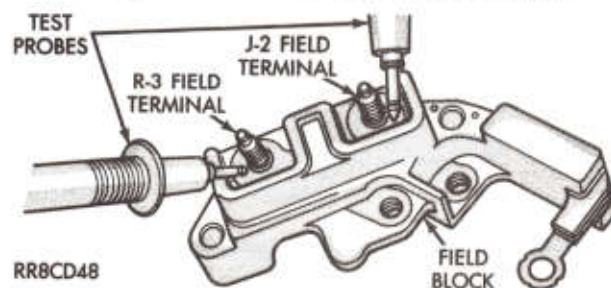


Fig. 5—Test Field Block R-2 to J-3 Terminals

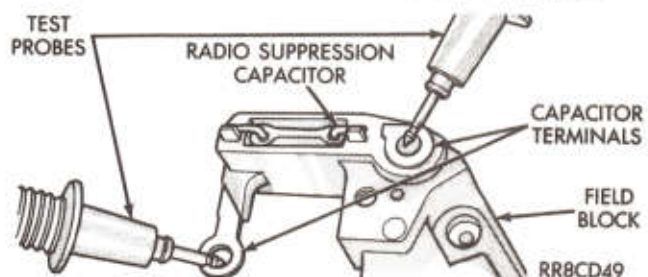


Fig. 6—Test Field Block Radio Capacitor

Rectifier Tests

(1) Inspect the rectifier assembly for poor solder joints, cracks, loose terminals, or signs of overheating (Fig. 7).

(2) Using a suitable scraping device, remove a small area of coating from each diode location to assure good electrical contact during testing (Fig. 8).

(3) With an analog ohmmeter or DVOM diode tester, negative test probe to stator terminal and positive test probe to negative diode location, test for resistance (7 to 11 ohms or .4 to .6 volt drop). Then place the positive test probe on the positive diode location, NO continuity should be detected. Perform the preceding procedure on each stator terminal to diode set (Fig. 9).

(4) With positive test probe to stator terminal and negative test probe to positive diode location, test for resistance (7 to 11 ohms or .4 to .6 volts drop). Then place the negative test probe on the negative diode location, NO continuity should be detected. Perform the preceding procedure on each stator terminal to diode set (Fig. 10).

If failure is detected, replace the rectifier assembly.

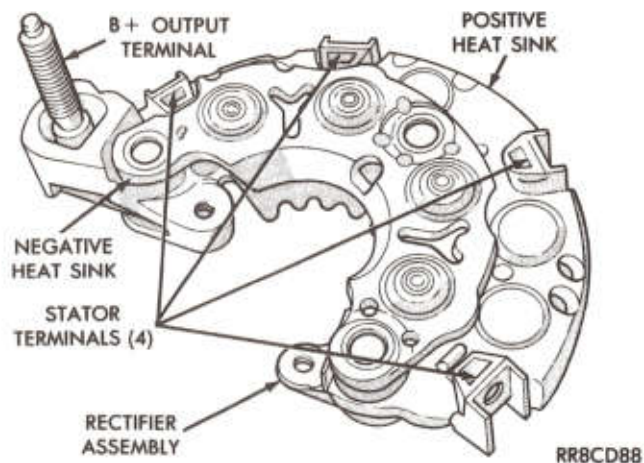


Fig. 7—Inspect Rectifier for Damage

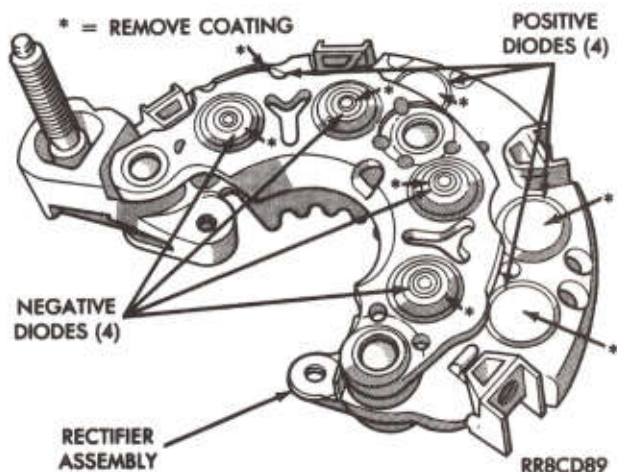


Fig. 8—Remove Coating from Diode Locations

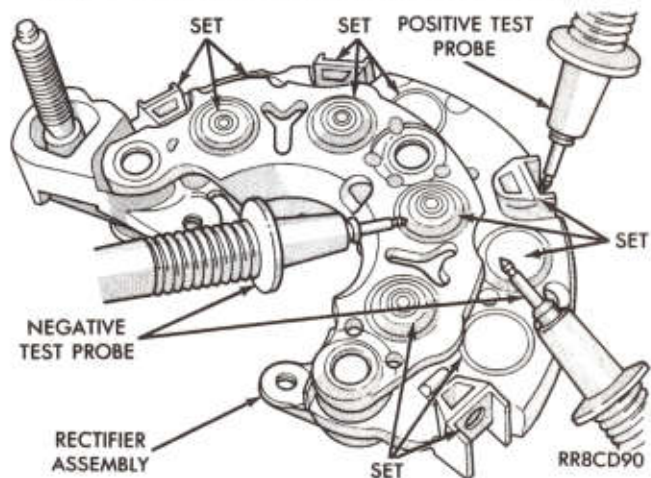


Fig. 9—Testing Diodes

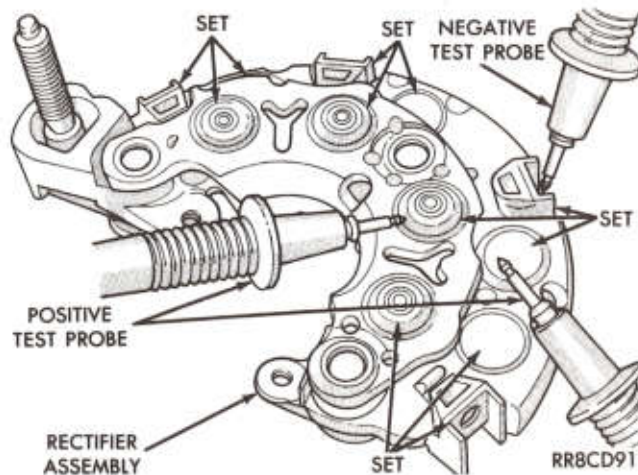


Fig. 10—Testing Diodes

Rotor Tests

(1) Inspect the field slip rings for excessive wear or roughness. Minor damage can be dressed out with a fine emery cloth. If the slip rings are too badly damaged, the rotor should be replaced.

(2) Using an ohmmeter, test for continuity from one slip ring to the other; the circuit should be closed (Fig. 11).

(3) Test for continuity from both of field coil slip rings to the rotor shaft or core, it should test open (Fig. 12).

If failure is detected, replace the rotor assembly.

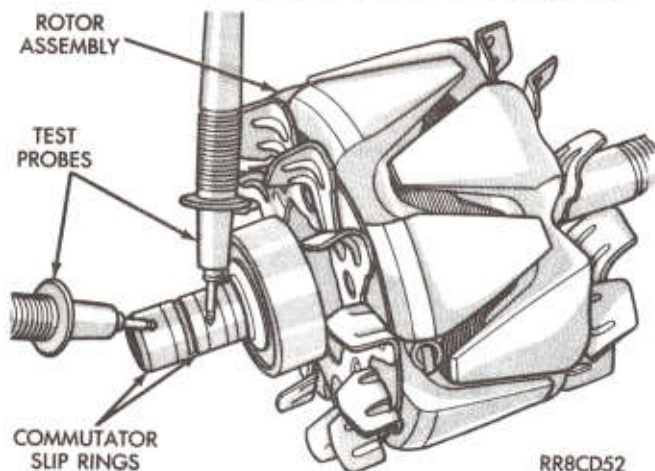


Fig. 11—Test Rotor Field Circuit

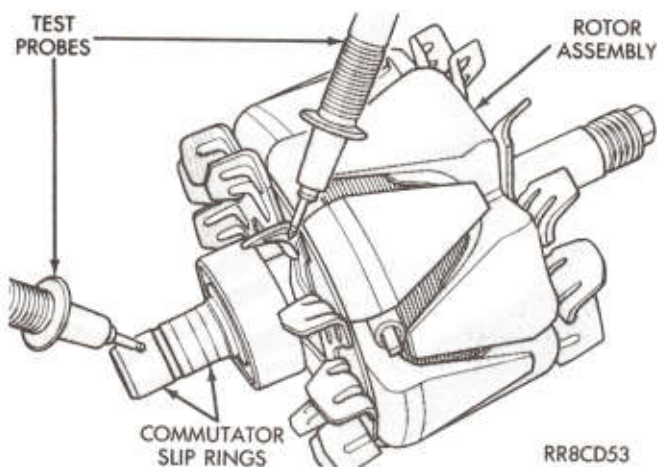


Fig. 12—Test Rotor Field Circuit for Ground

Stator Tests

(1) Using an ohmmeter, test for continuity from the stator leads (4) to the stator end shield, it should test open (Fig. 13).

(2) Test for continuity from one stator lead to the other three, the circuit should be closed (Fig. 14).

If failure is detected, replace the stator.

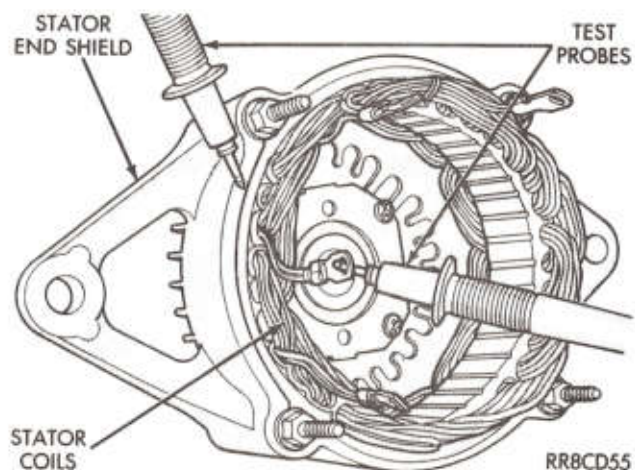


Fig. 13—Test Stator Circuit for Ground

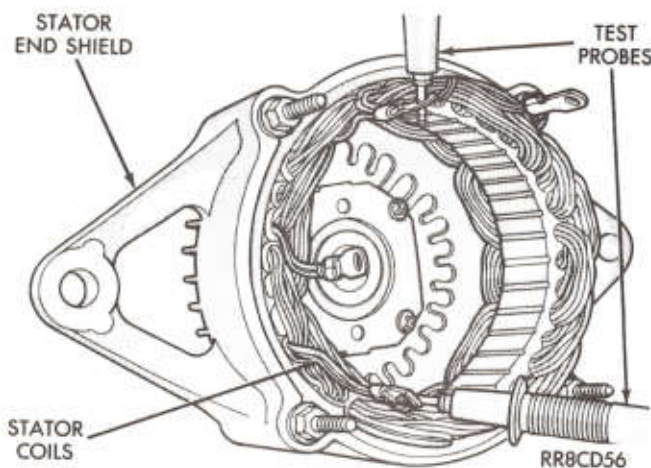


Fig. 14—Test Stator Circuit

SPECIFICATIONS

CHRYSLER 90HS ALTERNATOR WITH EXTERNAL VOLTAGE REGULATOR	
Part Number	5233472
Pulley Size	70 mm = 2.66:1 Ratio
Pulley Grooves	2 Grooves
Rotation	Clockwise (as viewed from pulley end)
Voltage	12 Volt System
Current Output	Design Controlled
Voltage Output	Limited by Voltage Regulator in Engine Electronics
Brushes (Field)	2
Condenser Capacity	0.5 Microfarad plus or minus 20%
Field Current Draw (Bench Test) Rotating by Hand ...	2.5 to 5.0 Amperes @ 12V
Current Rating	90 HS
Current Output	87 Amp Minimum Full Fielded 1250 Engine rpm
CHRYSLER 120HS ALTERNATOR WITH EXTERNAL VOLTAGE REGULATOR	
Part Number	5233199
Pulley Size	70 mm = 2.66:1 Ratio
Pulley Grooves	2 Grooves
Rotation	Clockwise (as viewed from pulley end)
Voltage	12 Volt System
Current Output	Design Controlled
Voltage Output	Limited by Voltage Regulator in Engine Electronics
Brushes (Field)	2
Condenser Capacity	0.5 Microfarad plus or minus 20%
Field Current Draw (Bench Test) Rotating by Hand ...	2.5 to 5.0 Amperes @ 12V
Current Rating	120 HS
Current Output	98 Amp Minimum Full Fielded 1250 Engine rpm
NIPPONDENSO 75HS ALTERNATOR WITH EXTERNAL VOLTAGE REGULATOR	
Part Number	5227673
Pulley Size	70 mm = 2.66:1 Ratio
Pulley Grooves	2 Grooves
Rotation	Clockwise (as viewed from pulley end)
Voltage	12 Volt System
Current Output	Design Controlled
Voltage Output	Limited by Voltage Regulator in Engine Electronics
Brushes (Field)	2
Condenser Capacity	0.5 Microfarad plus or minus 20%
Field Current Draw (Bench Test) Rotating by Hand ...	2.5 to 5.0 Amperes @ 12V
Rating	75 HS
Current Output	68 Amp Minimum Full Fielded 1250 Engine rpm

NIPPONDESE 90HS ALTERNATOR WITH EXTERNAL VOLTAGE REGULATOR	
Part Number	5227672
Pulley Size	70mm = 2.66:1 Ratio
Pulley Grooves	2 Grooves
Rotation	Clockwise (as viewed from pulley end)
Voltage	12 Volt System
Current Output	Design Controlled
Voltage Output	Limited by Voltage Regulator
Brushes (Field)	2
Condenser Capacity	0.5 Microfarad plus or minus 20%
Field Current Draw (Bench Test) Rotating by Hand ...	2.5 to 5.0 Amperes @ 12V
Rating	90 HS
Current Output	87 Amp Minimum Full Fielded 1250 Engine rpm

IGNITION SYSTEMS

CONTENTS

	Page		Page
ELECTRONIC CONTROL UNIT (ECU)		SINGLE MODULE ENGINE CONTROLLER (SMEC)	
IGNITION SYSTEM (5.9L ENGINE)	11	IGNITION SYSTEM (3.9L AND 5.2L	
GENERAL INFORMATION	1	ENGINES)	1
		SPECIFICATIONS	33

GENERAL INFORMATION

The information in this group describes the basic Ignition System diagnostic procedures for the 3.9L, 5.2L and 5.9L engines in general.

Information concerning "On Board Diagnostics" can be found in Group 14, Single Point Fuel Injection.

Specifications for ignition related items can be

found in Specifications at the rear of this section.

General maintenance information for ignition related items can be found in Lubrication & Maintenance, Group O, and the Operating Instructions & Product Information Manual.

SINGLE MODULE ENGINE CONTROLLER (SMEC)

IGNITION SYSTEM (3.9L AND 5.2L ENGINES)

	Page		Page
Component Identification	1	Service Procedures	5
Diagnostic Procedures	3		

COMPONENT IDENTIFICATION

INDEX

	Page		Page
Auto Shutdown (ASD) Relay	2	Manifold Absolute Pressure (MAP) Sensor	2
Coolant Temperature Sensor	2	Single Module Engine Controller (SMEC)	1
Hall Effect Pick-Up Assembly	2		

SINGLE MODULE ENGINE CONTROLLER (SMEC) (Fig. 1)

The SMEC controls the entire ignition system (Fig. 1). It gives the capability of igniting the fuel mixture according to different engine conditions during a run-drive period by delivering an infinite amount of variable electronic spark advance curves. The SMEC has a built-in microprocessor that continually receives input from the engine monitoring sensors. The computer then electronically advances or retards the ignition timing to provide even driveability during operation.

During the crank-start period the SMEC will provide a set amount of advanced timing to assure a quick efficient start.

The amount of electronic spark advance provided by the SMEC is determined by three input factors, coolant temperature, engine rpm, and available manifold vacuum.

The SMEC also receives information from the Oxy-

gen Sensor and electronically adjusts the air-fuel mixture to assure the most efficient fuel burn possible.

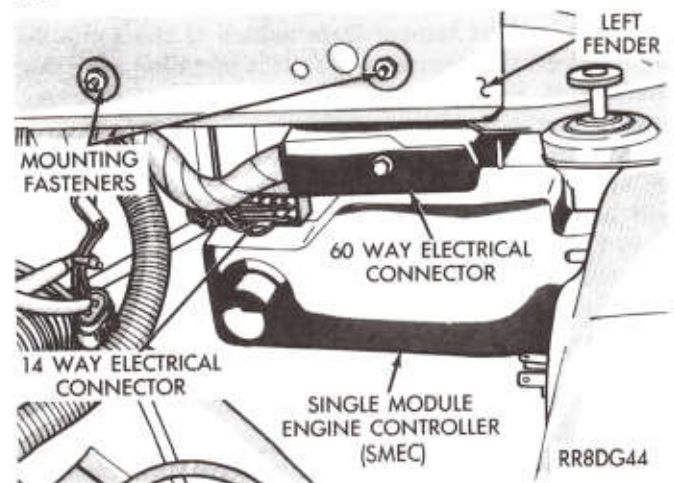


Fig. 1—Single Module Engine Controller (SMEC) Mounting Location

Hall Effect Pick-Up Assembly (Fig. 2)

The hall effect pick-up is located in the distributor assembly and supplies the engine rpm, and ignition timing data to the SMEC to advance or retard the ignition spark as required by running condition.

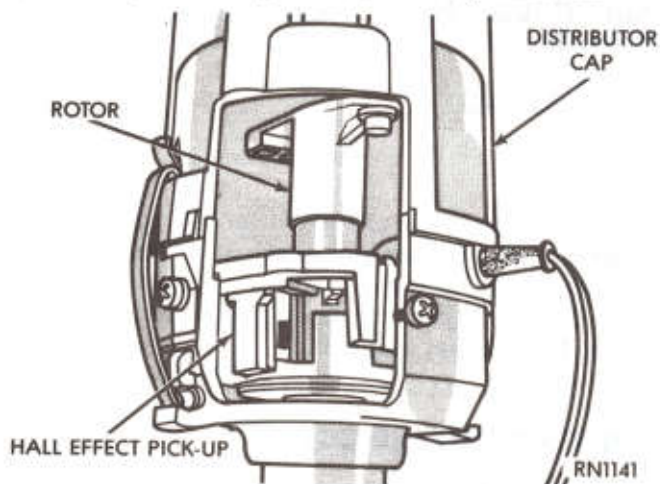


Fig. 2—Hall Effect Distributor

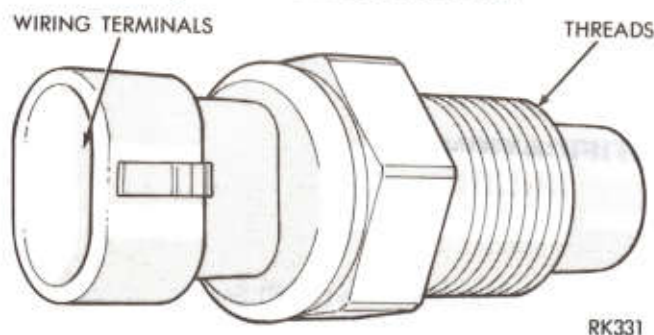


Fig. 3—Coolant Temperature Sensor

COOLANT TEMPERATURE SENSOR (Fig. 3)

The Coolant Temperature Sensor is a device which monitors coolant temperature (which is the same as engine operating temperature). It is mounted near the thermostat housing. This sensor provides data on engine operating temperature to the SMEC.

Incorporated in the digital microprocessor electronics are some unique spark advance schedules which will occur during cold and warm engine operation. They have been added to reduce engine emission and improve driveability. Because they will be changing at different engine operating temperatures during warm-up, all spark advance testing should be done with the engine fully warmed. This data allows the SMEC to demand slightly richer air-fuel mixtures and higher idle speeds until normal operating temperatures are reached. The sensor is a variable resistor with a range of -40°F to 265°F .

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR (Fig. 4)

The Manifold Absolute Pressure (MAP) sensor is a device which monitors manifold vacuum. It is mounted underhood on the dash panel and is connected to a vacuum nipple on the throttle body and electrically to the single module engine controller (SMEC). The sensor transmits information on manifold vacuum conditions to the SMEC. The MAP sensor data on engine load is used with data from other sensors to determine the correct air fuel mixture.

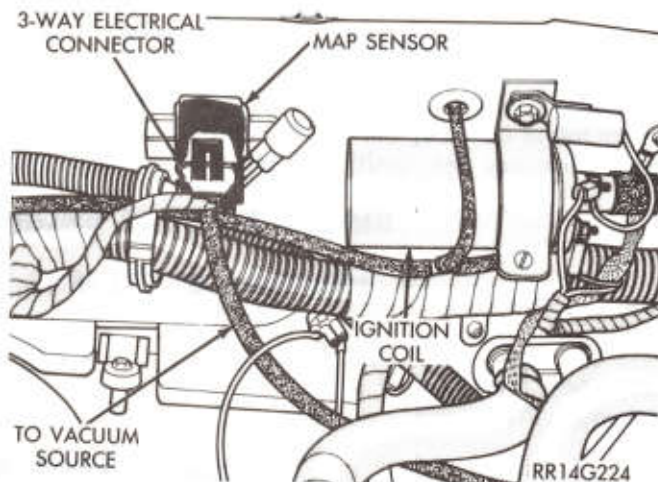


Fig. 4—MAP Sensor

AUTO SHUTDOWN (ASD) RELAY (Fig. 5)

When there is no ignition signal present with the ignition key in the "RUN" position, there is no need for fuel delivery. When this condition occurs the auto shutdown relay interrupts power to the electric fuel pump, fuel injectors, and ignition coil.

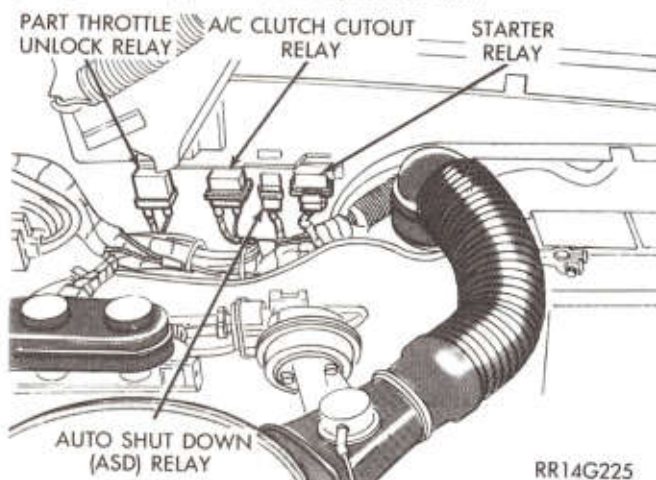


Fig. 5—Relay Identification

DIAGNOSTIC PROCEDURES

INDEX

	Page		Page
Coolant Temperature Sensor Test	4	Sensor Specifications	33
Failure to Start Test	3	Testing for Spark at Coil	3
Manifold Absolute Pressure (MAP) Sensor Test ..	4	Testing Spark Advance of the Single Module	
Poor Performance Test	4	Engine Controller (SMEC)	4

Refer to "On Board Diagnostics" in the General Diagnosis section of Group 14, Throttle Body Fuel Injection for more information.

TESTING FOR SPARK AT COIL

Remove coil secondary cable from distributor cap. Hold end of cable about 6mm (1/4-inch) away from a good engine ground (Fig. 1). Crank the engine and look for a spark at coil secondary cable.

If there is a spark at coil secondary cable it must be constant. If it is, have helper continue to crank engine and while slowly moving coil secondary cable away from ground, look for arcing at the coil tower. If arcing occurs replace coil. If spark is not constant or there is no spark, proceed to the failure to start test.

If spark is good and there is no arcing at the coil tower, the ignition system is producing the necessary high secondary voltage. However, make sure that this voltage is getting to the spark plugs by checking the distributor rotor, cap, spark plug cables, and spark plugs. If they are okay, then the ignition system is not the reason why the engine will not start. It will be necessary to check the fuel system and engine mechanical items.

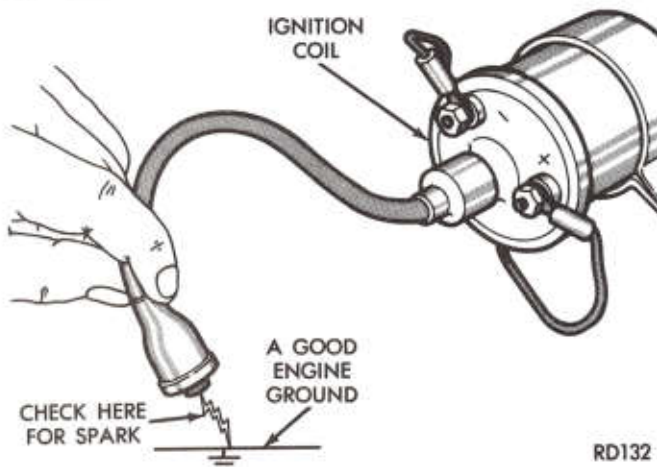


Fig. 1—Checking for Spark

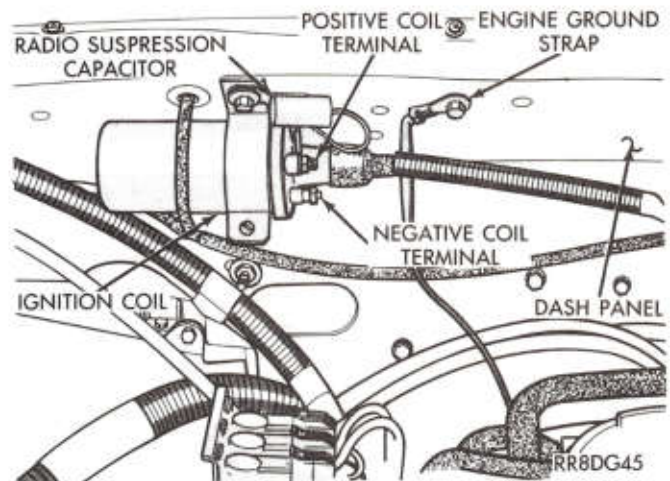


Fig. 2—Coil Terminals

FAILURE TO START TEST

Before proceeding with this test make sure "Testing For Spark At Coil" has been performed. Failure to do this may lead to unnecessary diagnostic time and wrong test results.

WARNING: BE SURE TO SET PARKING BRAKE OR BLOCK THE DRIVE WHEELS BEFORE PROCEEDING WITH THIS TEST.

- (1) Determine that sufficient battery voltage (12.4 volts) is present for the cranking and ignition systems.
- (2) Crank the engine for 5 seconds while monitoring the voltage at coil (+). If the voltage remains near zero during the entire period of cranking, see Group 14 for On-Board Diagnostic checks for the Single Module Engine Controller (SMEC) and auto shutdown relay.
- (3) If voltage is at "near-battery" voltage and drops to zero after 1-2 seconds of cranking, see Group 14 for On-Board Diagnostic check for the distributor reference pickup circuit to the SMEC.
- (4) If voltage remains at "near battery" voltage during the entire 5 seconds, remove the 14-way connector (Fig. 4) from the SMEC (with the key off). Check 14-way connector for any spread terminals.
- (5) Remove the lead to coil (+) and connect a jumper wire between battery (+) and coil (+).

(6) Using the special jumper (Fig. 3), momentarily ground terminal #12 of the 14-way connector. A spark should be generated when the ground is removed.

(7) If spark is generated, replace the SMEC.

(8) If no spark is seen, use the special jumper to ground the coil (-) terminal directly.

(9) If spark is produced, repair wiring harness for an open condition.

(10) If no spark is produced, replace the ignition coil.

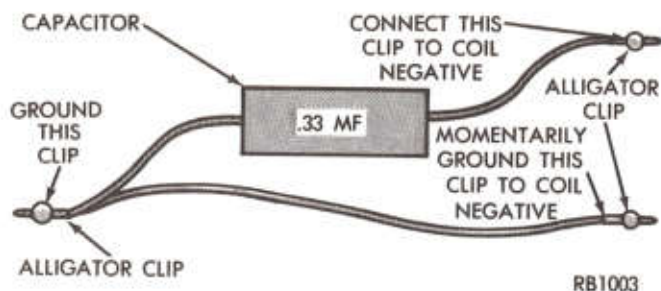


Fig. 3—Special Jumper to Ground Coil Negative

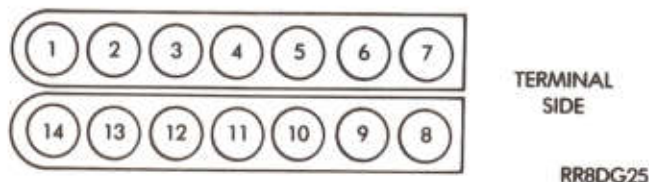


Fig. 4—14-Way Electrical Connector Single Module Engine Controller

POOR PERFORMANCE TEST

Before proceeding with test make sure "Testing For Spark At Coil" has been performed. Failure to do this may lead to unnecessary diagnostic time and wrong test results.

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TESTS.

Check and adjust basic timing (refer to the specification section of this group and see service procedures).

Refer to Group 14, General Diagnosis "On Board Diagnostics."

TESTING SPARK ADVANCE OF THE SINGLE MODULE ENGINE CONTROLLER (SMEC)

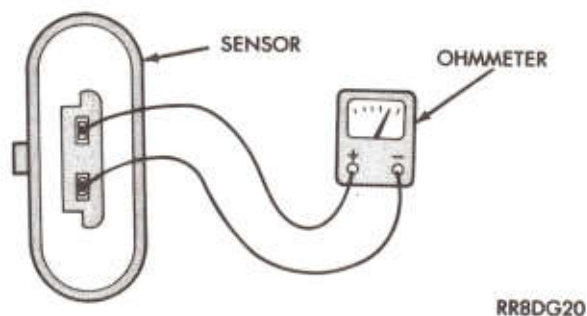
(1) Set basic timing. (See ignition timing procedure under Service Procedures).

(2) Engine at operating temperature. The temperature sensor must be connected and working properly.

(3) Raise engine speed to 2000 rpm, wait one minute and check specifications. Advance specifications are in addition to basic advance.

WARNING: WHILE PERFORMING THESE TESTS, IT IS NECESSARY TO USE A METAL EXHAUST TUBE. THE USE OF A RUBBER HOSE MAY RESULT IN A FIRE DUE TO HIGH TEMPERATURES AND A LONG TEST PERIOD.

If the SMEC fails to obtain specified settings, replace the SMEC.



RR8DG20

Fig. 5—Coolant Temperature Sensor Test
COOLANT TEMPERATURE SENSOR TEST (Fig. 5)

(1) With key off, disconnect wire connector from coolant temperature sensor.

(2) Connect one lead of ohmmeter to one terminal of coolant temperature sensor.

(3) Connect the other lead of ohmmeter to remaining connector of coolant temperature sensor. The ohmmeter should read as follows:

Engine/Sensor hot at normal operating temperature around 200°F should read approximately 700 to 1,000 ohms.

Engine/Sensor at room temperature around 70°F, ohmmeter should read approximately 7,000 to 13,000 ohms.

See "On Board Diagnostics" in the General Diagnosis section of Group 14, for further test procedures.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR TEST

Refer to Group 14, General Diagnosis "On Board Diagnostics."

SERVICE PROCEDURES

INDEX

	Page		Page
Coolant Temperature Sensor	5	Ignition Timing Procedure	9
Distributor Cap	6	Rotor	6
Distributor Removal and Installation 3.9L and 5.2L Engines	10	Single Module Engine Controller (SMEC)	5
Hall Effect Pick-up Assembly Replacement	10	Spark Plugs	7
Idle RPM Test	8	Spark Plug Cables	6
Ignition Coil	5	Spark Plug Service	8

SINGLE MODULE ENGINE CONTROLLER (SMEC)

CAUTION: Do not remove grease from 14-way connector or connector cavity in Computer. The grease is used in order to prevent moisture from corroding the terminals. If there isn't at least 1/8 inch of grease on bottom of computer connector cavities, apply a liberal amount of Mopar Multi-purpose grease Part No. 2932524 or equivalent over the entire end of connector plug before reinstalling.

Removal

When replacement of Single Module Engine Controller (SMEC) is necessary proceed as follows:

- (1) Remove air cleaner duct from SMEC.
- (2) Remove (3) module mounting screws (Fig. 1).
- (3) Remove 14- and 60-way wiring connectors from the SMEC and remove SMEC (Fig. 1).

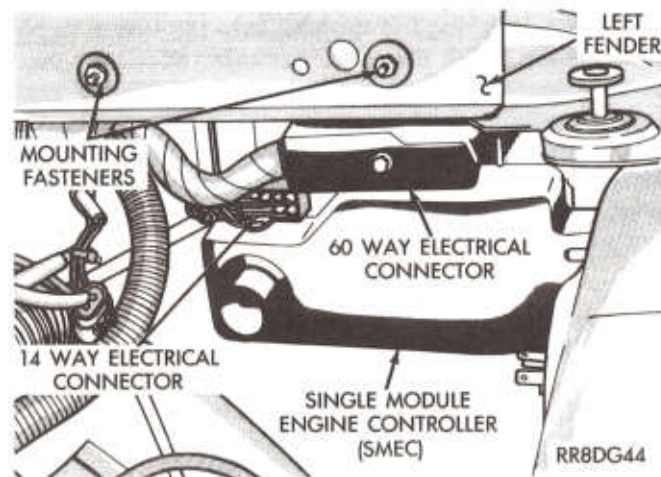


Fig. 1—Servicing the Single Module Engine Controller (SMEC)

Installation

- (1) Reconnect 14- and 60-Way Electrical connectors to SMEC (Fig. 1).
- (2) Mount SMEC to left fender (Fig. 1). Install and tighten three (3) mounting screws.
- (3) Install air cleaner duct to SMEC.

COOLANT TEMPERATURE SENSOR (Fig. 2)

(1) Disconnect Electrical Connector from sensor. Remove sensor from engine (Fig. 2). Engine Coolant may be lost.

(2) Install sensor and torque to 20 ft. lbs. Reconnect electrical connector (Fig. 2).

(3) Replace any lost engine coolant (Refer to Group 7 Cooling System).

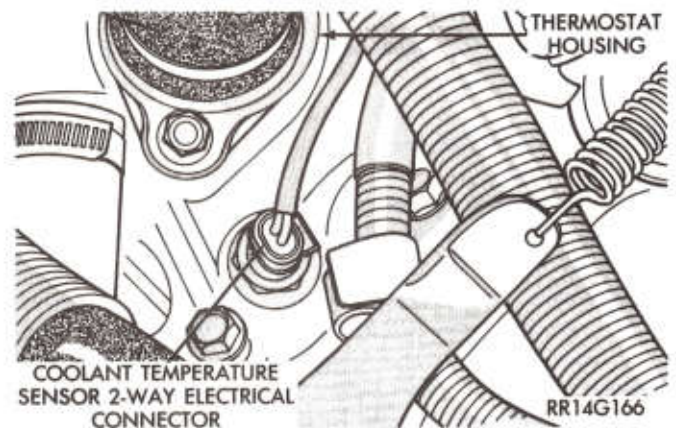


Fig. 2—Coolant Temperature Sensor

IGNITION COIL

The ignition coil is designed to operate without an external ignition resistor. Inspect the coil for external leaks and arcing.

Test coil according to coil tester manufacturer's instructions. Test coil primary resistance. Test coil secondary resistance. Replace any coil that does not meet specifications.

Every time an ignition coil is replaced because of a burned tower, carbon tracking, or any evidence of arcing at the tower, the nipple or boot on the coil end of the secondary cable, replace cable. Any arcing at the tower will carbonize the nipple so that placing it on a new coil will invariably cause another coil failure.

If secondary cable shows any signs of damage, cable should be replaced with a new cable since the old cable can cause arcing, and therefore, ruin a new coil.

DISTRIBUTOR CAP

Remove distributor cap and inspect the inside for flashover, cracking of carbon button, cracking of cap, and burned, worn terminals. If any of these conditions are present the distributor cap should be replaced.

Light scaling of the terminals, caused by the arcing of the spark from the rotor can be cleaned with a sharp knife. If heavy scaling of the terminals is present, the distributor cap should be replaced.

A cap that is greasy or dirty or has a powered like substance on the inside should be cleaned with a solution of warm water and a mild detergent. Scrub with a soft brush, thoroughly rinse, and dry with a clean soft cloth.

ROTOR

Inspect rotor for cracks, excessive burning of the tip, and improper tension of the spring terminal. If any of these conditions are present, the rotor should be replaced.

If heavy scaling of the rotor tip is present, the rotor should be replaced.

SPARK PLUG CABLES

Check the high-tension cable connections for good contact at the coil and distributor cap towers and at the spark plugs. Terminals should be fully seated. The nipples and spark plug covers should be in good condition. Nipples should fit tightly on the coil and cap towers and spark plug cover should fit tight around spark plug insulators. Cable connections that are loose will corrode and increase the resistance and permit water to enter the towers causing ignition malfunction. To maintain proper sealing between the towers and nipples, cable and nipple assemblies should not be removed from the distributor or coil towers unless nipples are damaged or cable testing indicates high resistance or broken insulation.

Clean high tension cables with a cloth moistened with a nonflammable solvent and wipe dry. Check for brittle or cracked insulation.

When testing secondary cables for punctures and cracks with an oscilloscope follow the instructions of the equipment manufacturers.

If an oscilloscope is not available, secondary cables can be tested as follows:

CAUTION: Do not leave any one spark plug wire disconnected any longer than necessary during test or possible heat damage to catalytic converter will occur. Total test time must not exceed ten minutes.

(a) Engine not running, connect one end of a test probe to a good ground, other end free for probing.

(b) With engine running, make test probe along entire length of all cables. If punctures or cracks are present there will be a noticeable spark jump from the faulty area to the probe. Secondary coil wire may be checked in the same manner. Cracked, leaking or faulty cables should be replaced.

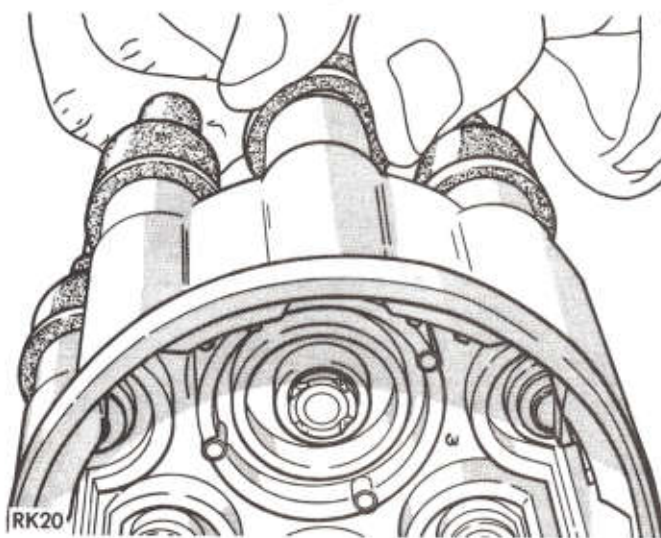


Fig. 3—Installing Secondary Cable and Nipple at Distributor Cap

When installing new cable assemblies, install new high tension cable and nipple assembly over cap or coil tower, entering the terminal into the tower, push lightly, then pinch the large diameter of nipple (Fig. 3) to release trapped air between the nipple and tower. Continue pushing on the cable and nipple until cables are properly seated in the cap towers. Use the same procedure to install cable in coil tower (Fig. 4). Wipe the spark plug insulator clean before reinstalling cable and cover.

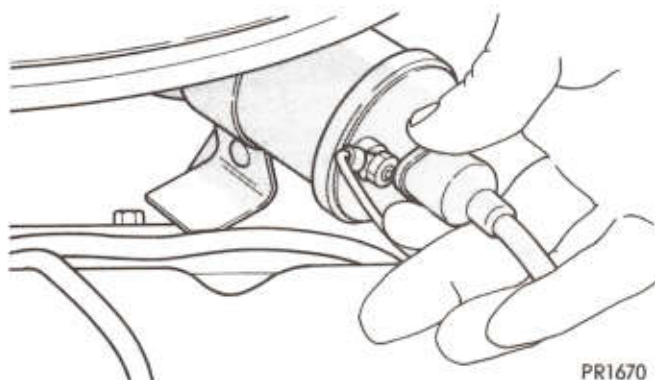


Fig. 4—Installing Secondary Cable and Nipple at Coil Tower

Use the following procedure when removing the high tension cable from the spark plug. First, remove the cable from the retaining bracket. Then grasp the insulator as close as possible to the spark plug rotate slightly and use a straight and steady pull. **Do not use pliers and do not pull the cable at an angle.** Doing so will damage the insulation, cable terminal or the spark plug insulator. **Wipe spark plug insulator clean before reinstalling cable and cover.**

Resistance type cable is identified by the words **Electronic Suppression** printed on the cable jacket.

Use an ohmmeter to check resistance type cable for open circuits, loose terminals or high resistance as follows:

- Remove cable from spark plug.
- Lift distributor cap from distributor with cables intact. **Do not remove cables from cap.**
- Connect the ohmmeter between spark plug end terminal and the corresponding electrode inside the cap, making sure ohmmeter probes are in good contact. If resistance is more than 50,000 ohms, remove cable at cap tower and check the cable resistance. If resistance is more than 50,000 ohms, replace cable assembly. Test all spark plug cables in same manner.

CABLE RESISTANCE CHART	
Minimum	Maximum
250 Ohms Per Inch	600 Ohms Per Inch
3000 Ohms Per Foot	7200 Ohms Per Foot

To test coil to distributor cap high tension cable, remove distributor cap with the cable intact. **Do not remove cable from the cap.** Connect the ohmmeter between center contact in the cap and either primary terminal at coil. If the combined resistance of coil and cable is more than 25,000 ohms, remove the cable at the coil tower and check cable resistance. If resistance is more than 15,000 ohms, replace the cable. If resistance is less, check for a loose connection at the tower or for a faulty coil.

Inspect coil tower for cracks, carbon tracking or oil leaks.

SPARK PLUGS

Resistor spark plugs are used in all engines and have resistance values of 7,500 to 15,000 ohms.

Spark Plug Conditions

Spark plug appearance or conditions can reflect a wide variety of engine conditions as follows:

Normal Conditions

Normal conditions (Fig. 5 left). This plug has been

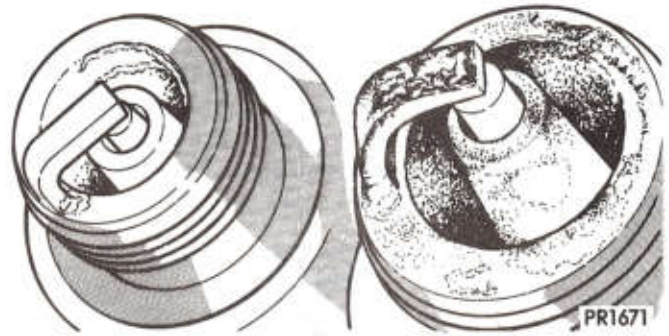


Fig. 5—Normal and Cold Fouling

running at the correct temperature in a "healthy" engine. The few deposits present will probably be light tan or gray in color with most regular grades of commercial gasoline. Electrode burning will not be in evidence; gap growth will average not more than about 0.025mm (0.001 in.) 1600 km (1000 miles). The plug as pictured, could be cleaned, the gap electrodes filed, regapped and reinstalled with good results.

Cold Fouling

Cold fouling or carbon deposits (Fig. 5 right). This dry black appearance is fuel carbon and can be due to overrich fuel-air mixture, possibly resulting from a faulty choke, clogged air cleaner, improper idle adjustment. However, if only one or two plugs in a set are fouled like this it is a good idea to check for worn or improperly installed valve guide seals, or faulty ignition cables. This condition also results from prolonged operation at idle.

Wet Fouling

Wet fouling (Fig. 6 left) tells you that the plug has drowned in excess oil. In an old engine, suspect worn rings or excessive cylinder wear. Remember that "break-in" fouling of new engines may occur before normal oil control is achieved. In new or recently overhauled jobs, such fouled plugs can be cleaned and reinstalled.

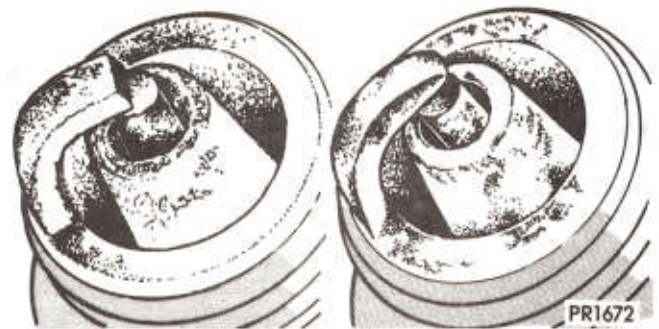


Fig. 6—Wet Fouling and Overheating

Overheating

Overheating (Fig. 6 right) is indicated by a white or light gray insulator which appears "blistered". Electrode wear rate will be considerably in excess of 0.025mm (0.001 in.)/1600 km (1,000 miles). Over-advanced ignition timing detonation and cooling system stoppages can overheat the spark plug.

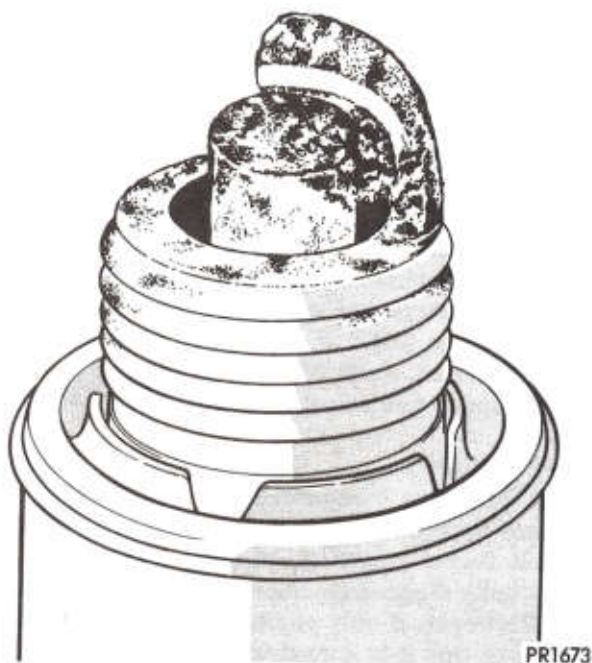


Fig. 7—Oil or Ash Incrusted

Oil or Ash Incrusted (Fig. 7)

If one or more plugs are oil or oil ash incrustrated, the engine should be evaluated for the true cause of oil entry into the combustion chamber.

Lead Deposits

Lead deposits are the result of using leaded gasoline.

High-Speed Miss

When replacing spark plugs because of a high-speed miss condition; wide open throttle operation should be avoided for approximately 80 km (50 miles) after installation of new plugs. This will allow deposit shifting in the combustion chamber to take place gradually and avoid plug destroying splash fouling shortly after the plug change.

SPARK PLUG SERVICE

Removal and Installation

At the time of removal or installation, pay heed to the following points:

- (1) When removing spark plug cables, grasp cable at spark plug boot.
- (2) Torque the spark plugs to 20 ft. lbs.

Inspection

Inspect the spark plugs for the following items. Clean or replace if necessary.

- (1) Cracked or damaged threads or insulator.
- (2) Worn electrodes.
- (3) Damaged or worn gasket.
- (4) Condition of burnt electrode and amount of carbon deposit.

Spark Plug Gap Adjustment

- (1) Check the plug gap with plug gap gauge. If gap is not within the specified limit, adjust by carefully bending the ground electrode.

IDLE RPM TEST

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TESTS.

Engine idle set rpm should be tested and recorded as it is when the vehicle is first brought into shop for testing. This will assist in diagnosing complaints of engine stalling, creeping and hard shifting on vehicles equipped with automatic transmissions.

Test procedures are as follows:

- (1) Connect red lead of test tachometer unit to negative primary terminal of coil and black lead to a good ground.
- (2) Turn selector switch to the appropriate cylinder position of engine being tested.
- (3) Turn tachometer rpm switch to 1,000 rpm position.
- (4) With engine at normal operating temperature, momentarily open the throttle and release it to make sure there is no bind in the linkage and that the throttle lever is against its stop.
- (5) Note engine rpm. Refer to EAR Label for correct engine idle rpm. If not within specification, see Group 14 "Fuel System" On-Board Diagnostic for throttle body minimum air-flow check procedure for 3.9L and 5.2L engines.

IGNITION TIMING PROCEDURE

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TESTS.

Check and Adjust Basic Ignition Timing 3.9L and 5.2L Engines

(1) Set the gearshift selector in park or neutral and apply the parking brake. All lights and accessories must be off.

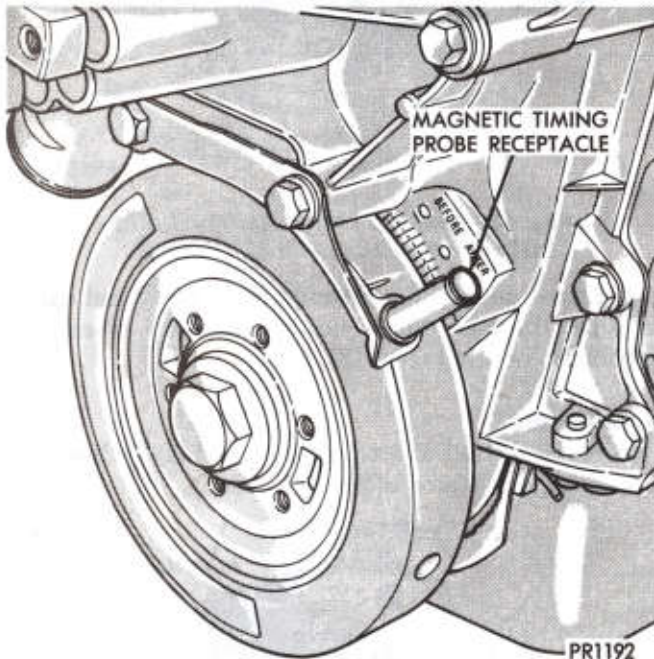


Fig. 8—Timing Marks

(2) Using a magnetic timing unit, insert the pickup probe into the open receptacle at the left front of the engine between the power steering and the water pumps. If a magnetic timing unit is not available, use a conventional power timing light connected to the number one cylinder spark plug wire.

Do not puncture cables, boots or nipples with test probes. Always use proper adapters. Puncturing the spark plug cables with a probe will damage the cables. The probe can separate the conductor and cause high resistance. In addition, breaking the rubber insulation may permit secondary current to arc to ground.

(3) Turn selector switch to the appropriate cylinder position.

(4) Start engine and run until operating temperature is obtained.

(5) With engine at normal operating temperature, disconnect coolant temperature sensor (Fig. 9). The I/P lamp should come on.

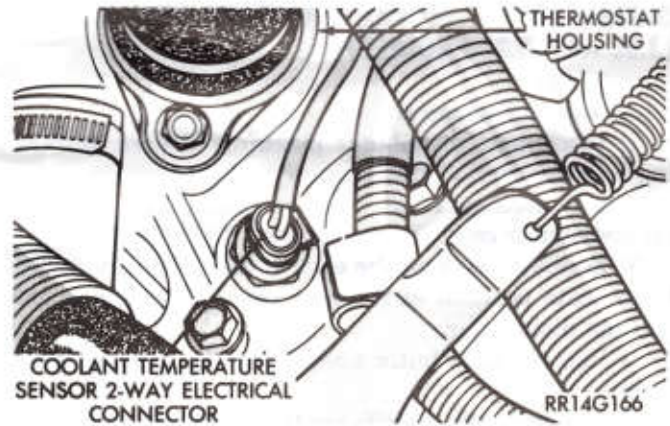


Fig. 9—Engine Coolant Temperature Sensor

(6) Aim Timing Light at front crankshaft pulley (Fig. 8) or read magnetic timing unit. If flash occurs when timing mark is before specified degree mark, timing is advanced. To adjust, turn distributor housing in direction of rotor rotation.

If flash occurs when timing mark is after specified degree mark, timing is retarded. To adjust, turn distributor housing against direction of rotor rotation. Refer to "EAR Label" for correct timing specification. If timing is within $\pm 2^\circ$ of value specified on the label, proceed to step (7). If outside specified tolerance, proceed to next step.

(7) Loosen distributor hold-down arm screw just enough so the distributor housing can be rotated in its mounting (Fig. 10). Turn distributor housing until specified label value is reached. Tighten the hold-down arm screw and recheck timing.

(8) Turn the engine off. Remove timing light or magnetic timing unit and tachometer. Reconnect coolant temperature sensor connector **Erase fault codes with sensor test #10**. Refer to Group 14 General Diagnosis, "On Board Diagnostics".

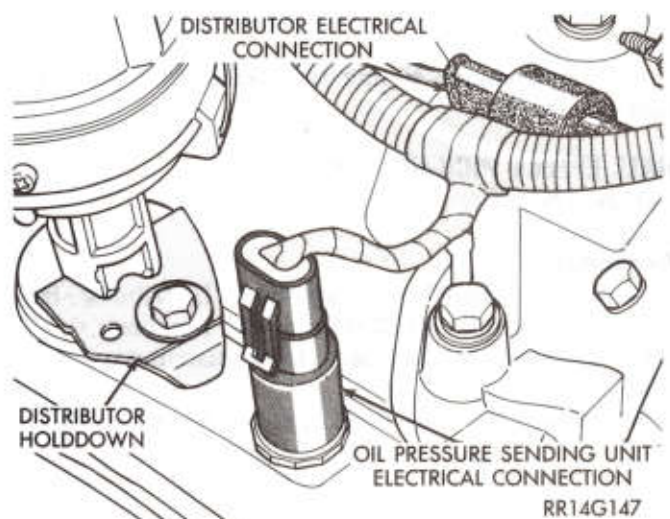


Fig. 10—Distributor Hold-Down

DISTRIBUTOR REMOVAL AND INSTALLATION (3.9L AND 5.2L ENGINES)

Distributor Removal

- (1) Disconnect distributor pickup lead wire at wiring harness connectors.
- (2) Unfasten distributor cap retaining clips and lift off distributor cap.
- (3) Scribe a mark on the edge of distributor housing to indicate position of rotor as reference when reinstalling distributor.
- (4) Remove distributor hold down clamp screw and clamp.
- (5) Carefully lift distributor from engine.

Distributor Installation

- (1) Position distributor in engine. Make sure rubber O-ring seal is in groove of distributor housing. Align rotor with marks previously scribed on distributor housing. Clean top of cylinder block to insure a good seal between distributor base and block.
- (2) Engage tongue of distributor shaft with slot in distributor oil pump drive gear. **If engine has been cranked while distributor is removed, it will be necessary to establish the proper relationship between distributor shaft and No. 1 piston position as follows:**

(a) Rotate crankshaft until number one piston is at top of compression stroke. Mark on crankshaft vibration damper should be in line with "O" TDC mark on timing chain case cover.

(b) Rotate rotor to position of number one distributor cap terminal.

(c) Lower distributor into opening, connect pickup coil leads and install distributor cap. Make sure all high-tension wires "snap" firmly in cap towers. Install distributor hold-down clamp screw. Tighten screw finger tight.

(3) Connect distributor pick-up lead wire(s) at wiring harness connectors.

(4) Adjust engine timing to Specification (refer to Ignition Timing).

HALL EFFECT PICK-UP ASSEMBLY REPLACEMENT

Removal

- (1) Remove distributor cap (See "Distributor Removal and Installation 3.9L and 5.2L Engines).
- (2) Remove ignition rotor from distributor shaft (Fig. 11).
- (3) Remove two hall effect pick-up attaching screws

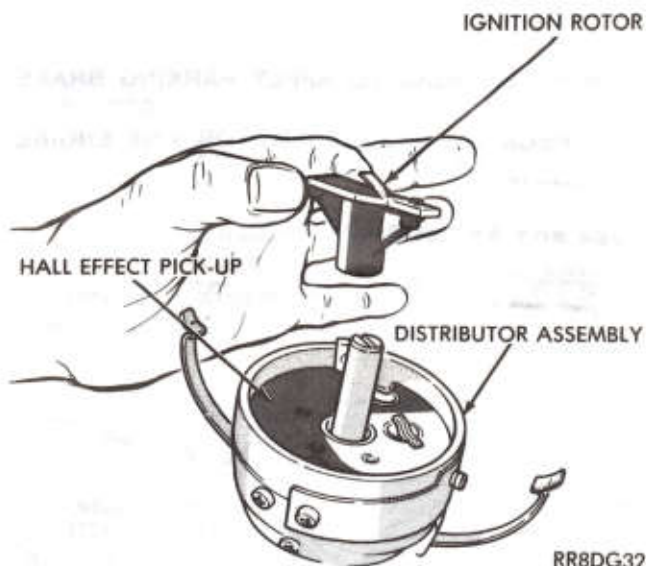


Fig. 11—Ignition Rotor Removal and Installation 3.9L and 5.2L Engines

on opposite sides of the distributor housing and carefully lift the hall effect pick-up assembly from the distributor housing (Fig. 12).

Installation

To reinstall hall effect pick-up assembly follow the preceding procedure in reverse order.

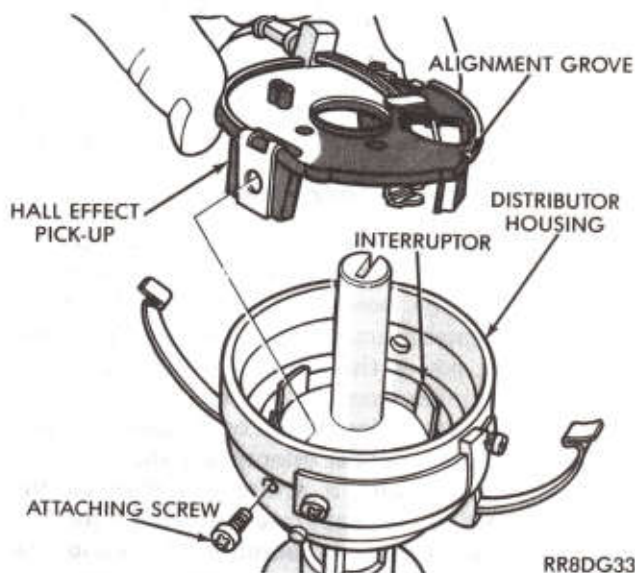


Fig. 12—Hall Effect Pick-Up Removal and Installation 3.9L and 5.2L Engines

ELECTRONIC CONTROL UNIT (ECU) IGNITION SYSTEM (5.9L ENGINE)

CONTENTS

	Page		Page
Electronic Ignition System	11	Test Procedures and Diagnosis	14
Service Procedures	25		
Specifications	33		

ELECTRONIC IGNITION SYSTEM

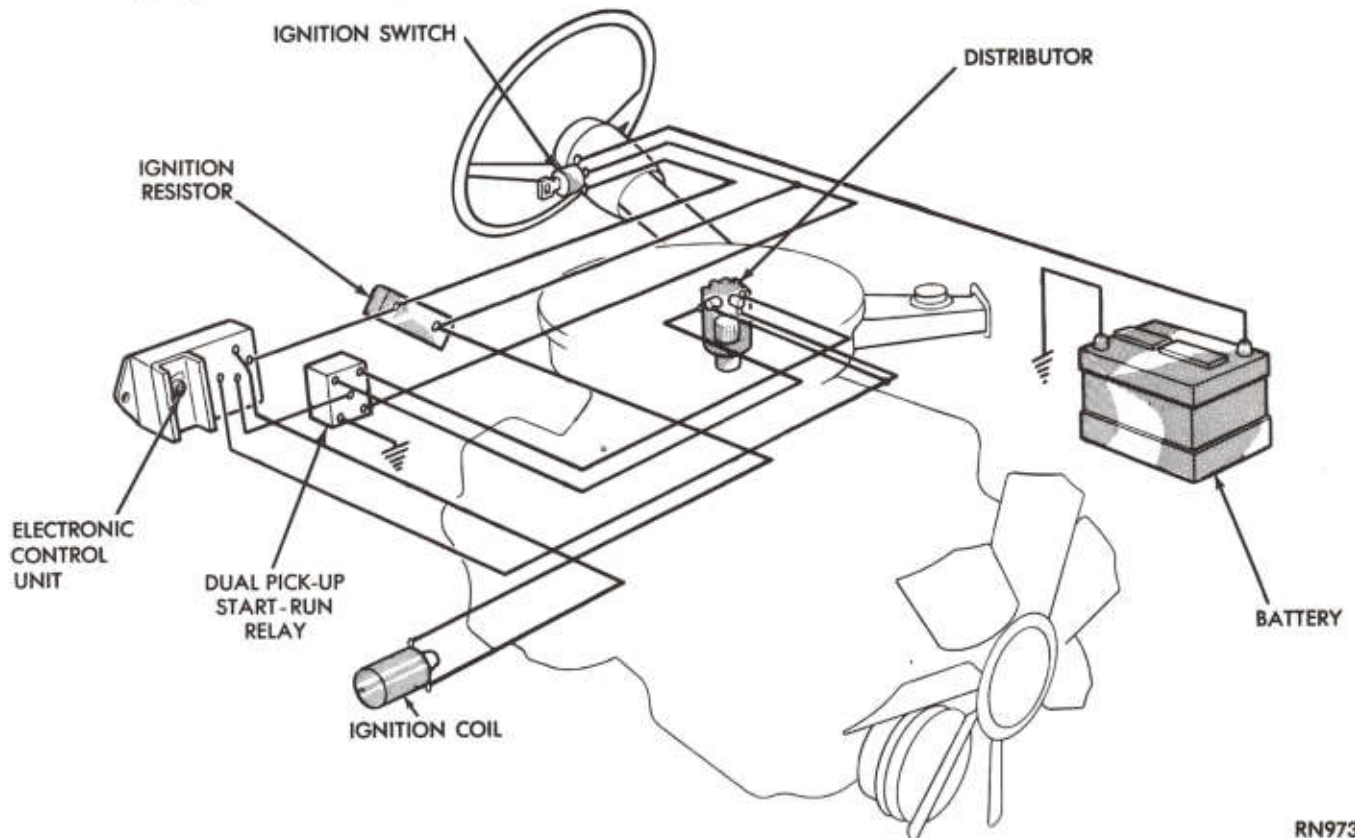
INDEX

	Page		Page
Electronic Ignition System	11	Secondary Circuit	12
Dual Pick-Up Start Run Relay	13	Thermal Ignition Distributor Control (TIDC) Valve ..	13
Pick-Up Coil and Control Unit Feed Circuit	12	TIDC Valve Test	13
Primary Circuit	12		

ELECTRONIC IGNITION SYSTEM

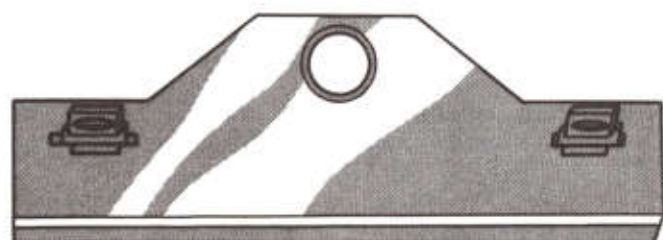
The Electronic Ignition System (Fig. 1) consists of the Battery, Ignition Switch, Ignition Resistor 5.9L

only (Fig. 2), Control Unit (Fig. 3), Coil, Single, or Dual Pick-Up Distributor (Fig. 4 and 5), Spark Plugs and all their Wiring, Insulators, Connectors, and Dual Pick-Up Start-run Relay on some models.



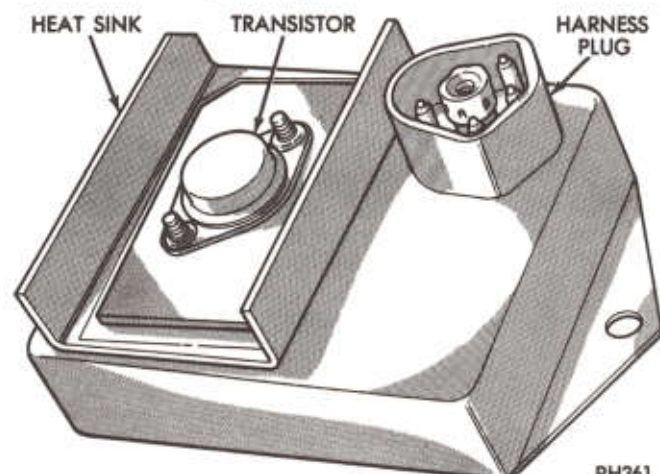
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Fig. 1—Electronic Ignition System 5.9L Only



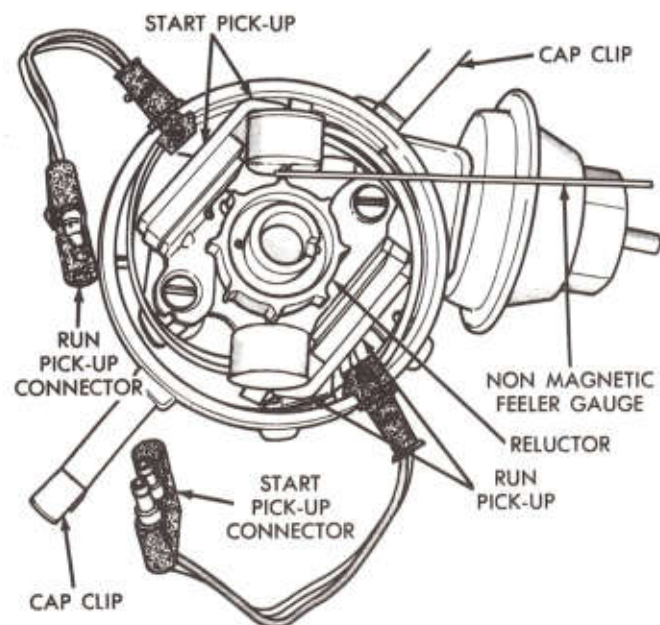
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Fig. 2—Ignition Resistor



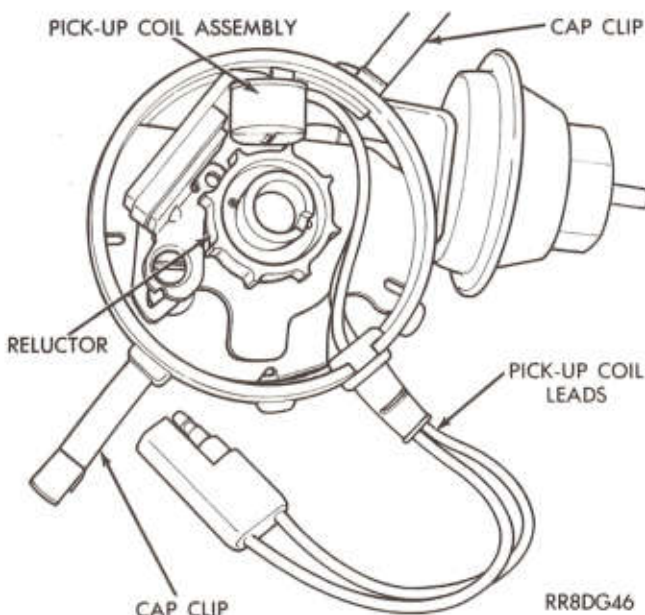
RH361

Fig. 3—Electronic Control Unit



RB1352

Fig. 4—Eight Cylinder Dual Pick-Up Distributor



RR8DG46

Fig. 5—Eight Cylinder Single Pick-Up Distributor

Primary Circuit

The primary circuit consists of battery, ignition switch, (1.2 ohm) ignition resistor, primary windings of ignition coil, power switching transistor of control unit, vehicle frame, and dual pick-up start-run relay (Fig. 6).

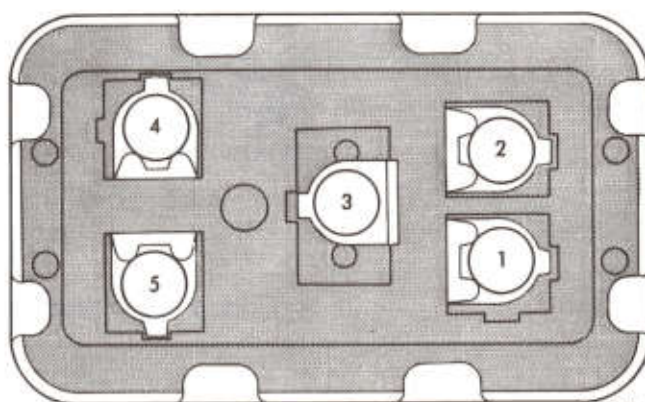
Secondary Circuit

The secondary circuit consists of coil secondary windings, distributor cap and rotor, spark plug cables, spark plugs, and vehicle frame.

On 5.9L engine during starting the ignition resistor is by-passed, applying full battery voltage to the ignition coil.

In addition to the two basic circuits there are two other circuits. They are the pick up coil circuit and control unit feed circuit.

One circuit is used to operate the circuitry of the control unit.



RB133

Fig. 6—Dual Pick-Up Start Run Relay

Pick-Up Coil and Control Unit Feed Circuit

The pick up circuit is used to sense the proper timing for the control unit switching transistor.

The reluctor rotating with the distributor shaft produces a voltage pulse in the magnetic pickup each time a spark plug should be fired. This pulse is transmitted through the pickup coil to the power switching transistor in the control unit and causes the transistor to interrupt the current flow through the primary circuit. This break in the primary circuit induces a high voltage in the secondary coil circuit and fires a spark plug.

The length of time that the switching transistor allows the flow of current in the primary circuit is determined by the electronic circuitry in the control unit.

Ignition maintenance is reduced to inspection of distributor cap, rotor, wiring, and cleaning and changing of spark plugs as needed.

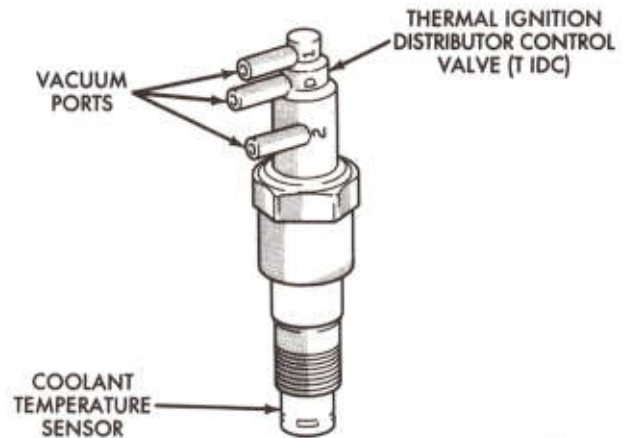
Dual Pick-Up Start Run Relay

The dual pick-up start-run relay on 5.9L vehicles only allows the use of a dual pick-up distributor without **ESA**. This has benefits of increased timing with improved fuel economy.

The relay is energized when the solenoid is energized through the ignition start switch.

THERMAL IGNITION DISTRIBUTOR CONTROL VALVE (TIDC) (Fig. 7)

The purpose of this valve is to direct manifold vacuum to the distributor vacuum advance unit when



RP870

Fig. 7—TIDC Valve (3 Port Vacuum Valve)

the engine is cold. The valve also directs ported vacuum to the vacuum advance unit when engine coolant temperature reaches 150°F (66°C).

TIDC Valve Test (Fig. 7)

- (1) With the engine cold-below 125°F (52°C), disconnect the vacuum harness from the TIDC valve.
- (2) Connect an auxiliary vacuum supply to the top nipple on the valve and apply vacuum.
- (3) If the valve holds vacuum, replace the valve; if not, proceed to step 4.
- (4) With the engine fully warmed up 195°F (90°C), connect an auxiliary vacuum supply to the top nipple of the valve and apply vacuum.
- (5) If the valve holds vacuum, the valve is good; if not, replace the valve.

TEST PROCEDURES AND DIAGNOSIS

ELECTRONIC IGNITION SYSTEM

INDEX

	Page		Page
Dual Pick-Up Start-Run Relay Test	20	Ignition Input Voltage Lamp	17
Electronic Exhaust Gas Recirculation (EGR)		Ignition Resistor Circuit Lamp (Tester	
System Test	24	C-4166A Only)	17
Electronic Ignition System Diagnosis	19	On Vehicle System Test	17
Electronic Ignition System Primary Circuit		Pick-Up Circuit Lamp	17
Diagnosis	15	Pick-Up Coil	18
Electronic Ignition System Secondary Circuit		Primary Circuit Lamp	17
Diagnosis	16	Electronic Ignition Test with Tester C-4503 and	
Electronic Ignition Tests with Tester C-4166 with		Adapter C-4503-3	18
Adapter C-4166-1 and Tester C-4166A	14	Control Unit Position	20
C-4166 With C-4166-1	17	Distributor Pick-Up Coil Position	20
C-4166A	17	Ignition Switch Position—Run and Start	
Circuit Breaker Switch	17	Lamps	20
Component Test Off Vehicle	18	Primary Position—Coil and Ballast Lamp	20
Control Unit	18	Electronic Ignition Test Without Tester	20
Control Unit Lamp	17	Electronic Throttle Control System Test	24
High Voltage Coil Test	17		

ELECTRONIC IGNITION TESTS

With Tester C-4166 with Adaptor C-4166-1 or Tester C-4166A (Fig. 1 and 2)

WARNING: PRIOR TO TESTING ELECTRONIC IGNI-

TION SYSTEM IN ANY VEHICLE, PLACE VEHICLE TRANSMISSION IN NEUTRAL OR PARK POSITION (PARK BRAKE APPLIED AND GEAR SELECTOR IN NEUTRAL ON MANUAL TRANSMISSION CARS) AND TURN IGNITION SWITCH TO OFF OR LOCK POSITION.

The ignition system can be tested with either following tester tools; however, the auxiliary 5 ohm ballast circuit has been replaced by **electronic control unit P/N 4111850**. This requires that auxiliary ballast light be ignored when ignition systems with an ECU P/N 4111850 are being tested.

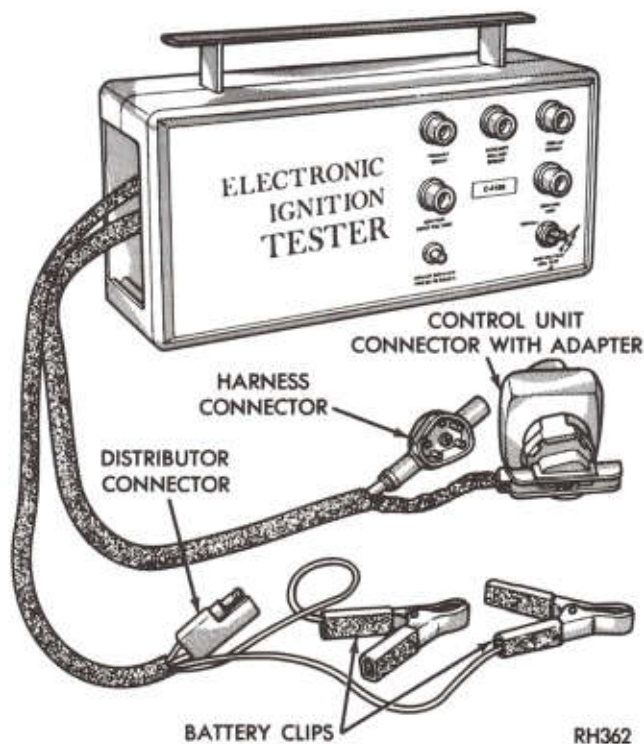


Fig. 1—Tester C-4166 with Adapter C-4166-1

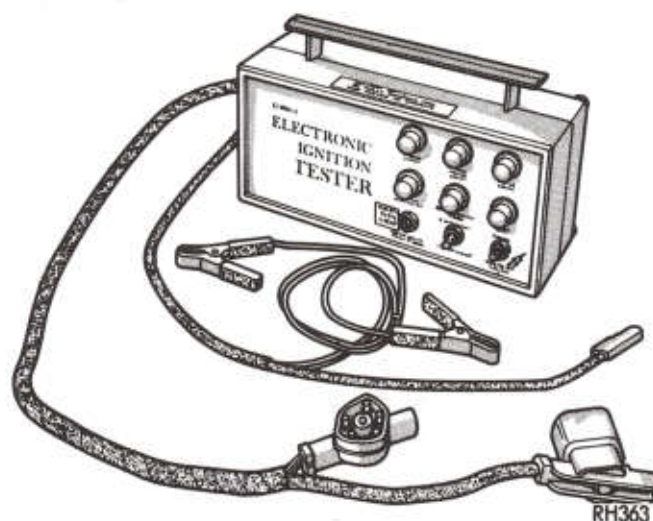
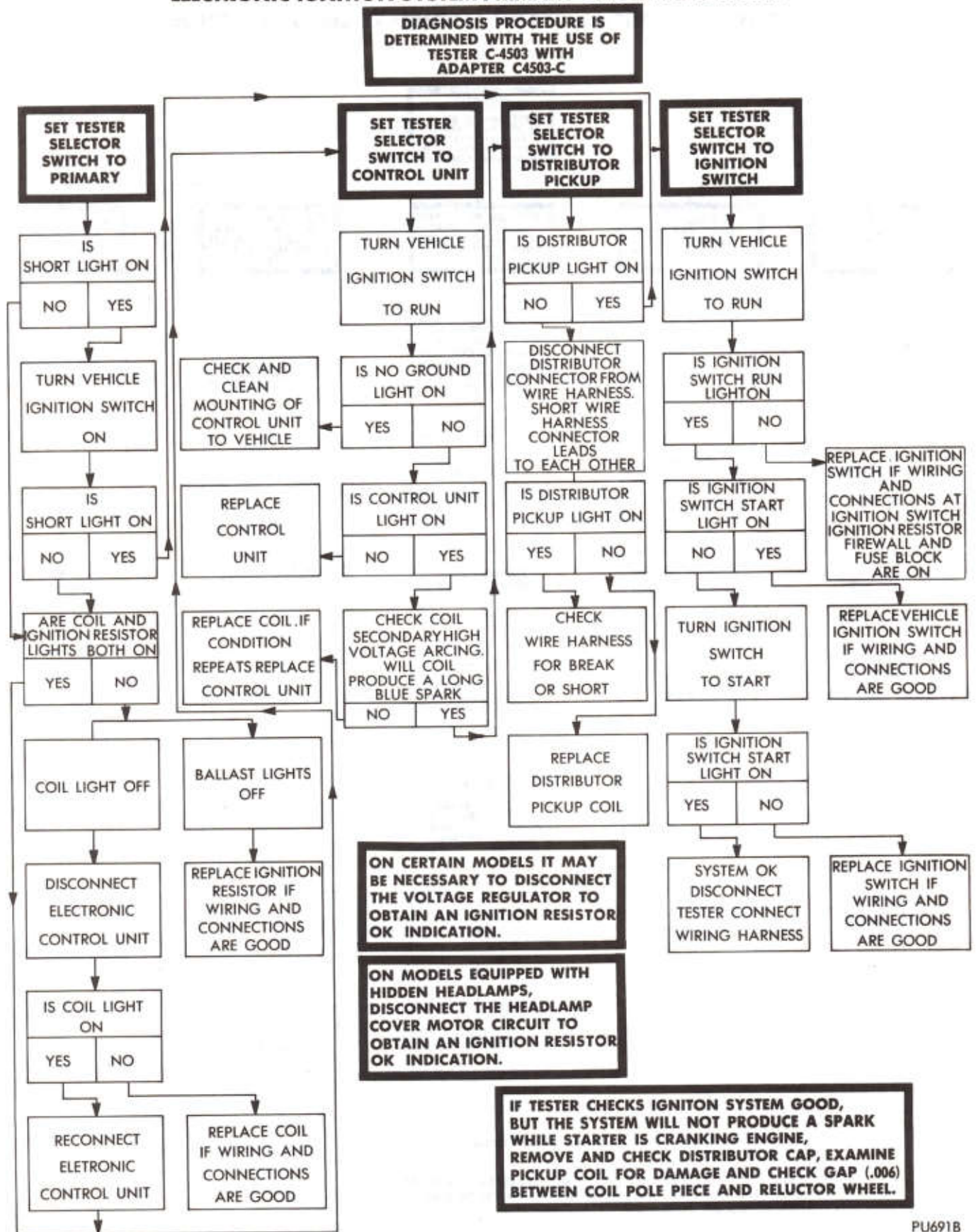
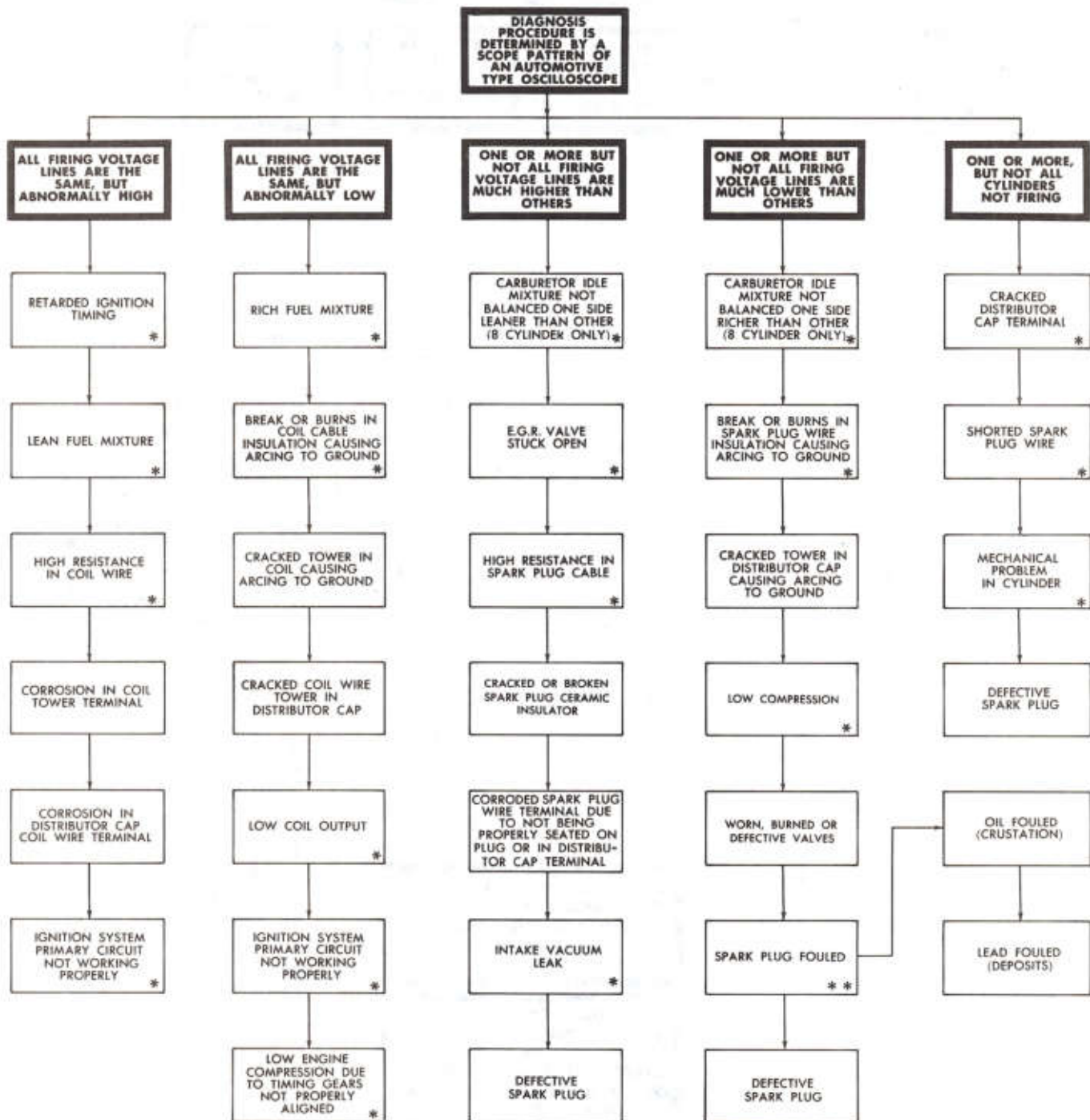


Fig. 2—Tester C-4166A

ELECTRONIC IGNITION SYSTEM PRIMARY CIRCUIT DIAGNOSIS



ELECTRONIC IGNITION SYSTEM SECONDARY CIRCUIT DIAGNOSIS



* ALL TESTS AND REPAIRS ARE DESCRIBED IN APPROPRIATE SECTION OF SERVICE MANUAL.

** SPARK PLUGS (DO NOT FOUL BY THEMSELVES.) CHECK FOR WHAT CAUSED PLUG TO FOUL. INSTALLING NEW SPARK PLUGS WILL NOT CORRECT FOULING CONDITION.

C-4166 with C-4166-1 (Fig. 1)

When using tester C-4166 the adapter C-4166-1 must be used.

C-4166-A (Fig. 2)

Tester C-4166-A has adapter circuit built into it. **Do not connect adapter C-4166-1 to it.** Also this tester has one additional red light and toggle switch for testing ignition resistor when performing on vehicle system test. It can not be used for off vehicle, component test.

On the Vehicle System Test

Test Preparation

CAUTION: The vehicle must have a fully charged 12 volt battery for the tester to accurately analyze the ignition system. **Do not proceed with test unless battery meets specifications.**

(1) With ignition switch in "Off" position, remove screw attaching wiring harness connector control unit.

(2) Connect female lead of tester wiring harness to control unit and male lead of tester to disconnected lead from control unit. This puts tester into vehicle ignition system.

CAUTION: Do not connect battery clips of tester to vehicle or any other battery. Do not connect distributor connector of tester to distributor lead on vehicle. The battery clips and distributor connector of tester are used only when testing components off the vehicle.

(3) Turn ignition switch to "On" position.

WARNING: DO NOT TOUCH TRANSISTOR ON CONTROL UNIT WHILE IGNITION SWITCH IS ON FOR ELECTRICAL SHOCK WILL BE OBTAINED.

Ignition Input Voltage Lamp

The **Green** ignition input voltage lamp must come on before any further tests can be made. If lamp does not come on ignition system input voltage is low or absent. Check vehicle battery, ignition switch, and control unit for a good ground, and associated wiring and connections until the fault is found, corrected, and **Green** lamp comes on.

Control Unit Lamp

The control unit **Green** lamp must come On to indicate control unit is functioning properly and that it is properly grounded. If lamp does not come on, first check connector pins on control unit for corrosion, or foreign matter. Then check control unit for a poor ground. If none of these conditions exists and lamp still remains off, control unit is malfunctioning and must be replaced.

High Voltage Coil Test

The high voltage coil test must be performed to completely test ignition system. Proceed only if ignition input and control unit **Green** lamps are both on, and all **Red** lamps are off.

Disconnect ignition coil secondary wire from distributor cap tower. Hold end of wire with insulated pliers about 1/4 inch from a good engine ground and then actuate the **High Voltage Coil Test Switch**. A good spark should be observed between wire and engine. While still holding coil test switch, pull wire away from engine ground until spark stops. Closely observe coil tower during movement to be sure that no arcing occurs.

Primary Circuit Lamp

The primary circuit **Red** lamp must be off to indicate that primary circuit is functioning properly. If lamp is on; check coil primary windings for continuity or shorts, suppression capacitor for shorts, ignition resistor, and wiring, for open or incorrect connections, until fault is found, corrected, and lamp goes out.

Pick Up Circuit Lamp

CAUTION: The pick up coil can be checked, with the tester at room temperature only, 70°-80°F (22°-27°C).

If pick up coil must be tested when engine is at operating temperature, refer to "electronic ignition test without tester", for correct testing procedure.

The pick up circuit red lamp must be off to indicate that pick up circuit is functioning properly. If lamp is On, first check the wiring and connections for continuity, corrosion, or shorts. If none of conditions exists and lamp is still On, pick up coil is malfunctioning and must be replaced.

Ignition Resistor Circuit Lamp (Tester C-4166-A Only)

The ignition resistor circuit **Red** lamp must be off when toggle switch is moved to 1.2 ohm position to indicate that ignition resistor circuit is functioning properly. If lamp comes On, first check wiring and connections for continuity, corrosion or shorts. If none of these conditions exists and lamp is still On, ignition resistor is malfunctioning and must be replaced.

Circuit Breaker Switch

The circuit breaker will protect the tester against damage due to testing a shorted control unit and if tester is left connected for a period of time in excess of what it takes to test the system. Wait 60 seconds before attempting to reset a popped circuit breaker. Also do not replace control unit unless **Green** control unit lamp was off before circuit breaker popped.

Component Test Off the Vehicle

Connect battery clips of tester to a fully charged battery. The **Green** ignition input voltage lamp will come **On** if the battery is supplying sufficient voltage for testing. If lamp does not come **On** do not proceed with test until battery is charged enough to turn **On** lamp.

Control Unit (Fig. 3)

The control unit should be tested as a component **off the vehicle**. However, in the event it is tested as a component on the vehicle, **make sure the correct polarity is followed when connecting the battery leads of tester to battery, black to negative, red to positive. Reversing the polarity will damage the tester and control unit.**

Only ignition input voltage and control unit lamps apply on this test. **Disregard any red lamps that may light.**

Connect wiring harness connector of tester to control unit. Control unit does not need to be grounded for this test. The control unit **Green** lamp must come **on** to indicate a good control unit. If lamp does not come **on** check all connector pins for corrosion and security. Check all plug holes to be sure they are clean. If lamp still does not come **on** control unit is defective.

Pick-Up Coil (Fig. 4)

The pick-up coil may be tested while assembled in distributor or as a separate unit. **Disregard all other lamps on tester except ignition input circuit lamp and pick-up circuit lamp.**

(1) Connect clips to battery and connect pick-up lead to proper tester lead. Red pick-up lamp will be **"off"** if pick-up is good. Check pick-up lead by flexing it to be sure that there are no intermittent faults in lead. If pick-up lamp blinks during flexing the pick-up coil assembly is malfunctioning and must be replaced.

(2) If pick-up lamp comes **"on"** replace pick-up coil assembly.

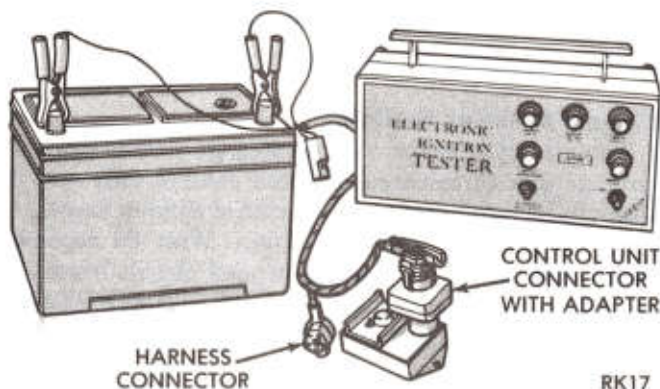


Fig. 3—Testing Control Unit Off Vehicle

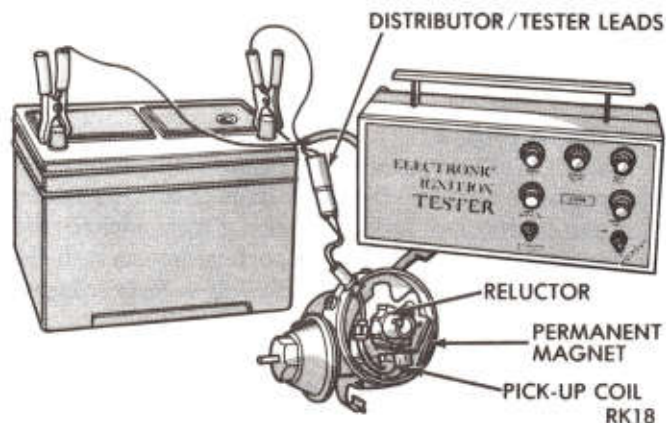


Fig. 4—Testing Pick-Up Coil Off Vehicle

ELECTRONIC IGNITION TESTS

With Tester C-4503 and Adaptor C-4503-3 (Fig. 5)

WARNING: PRIOR TO TESTING ELECTRONIC IGNITION SYSTEM IN ANY VEHICLE, PLACE VEHICLE TRANSMISSION IN NEUTRAL OR PARK POSITION (PARK BRAKE APPLIED AND GEAR SELECTOR IN NEUTRAL ON MANUAL TRANSMISSION CARS) AND TURN IGNITION SWITCH TO THE OFF OR LOCK POSITION.

Test Preparation

CAUTION: The vehicle must have a fully charged 12 volt battery for tester to accurately analyze ignition system. Do not proceed with test unless battery meets specifications.

(1) Connect Chrysler Adaptor Assembly (C4503-3) to

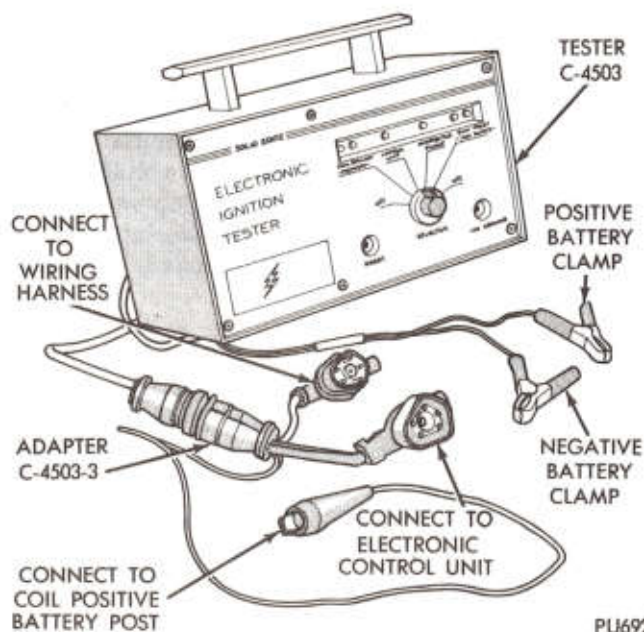
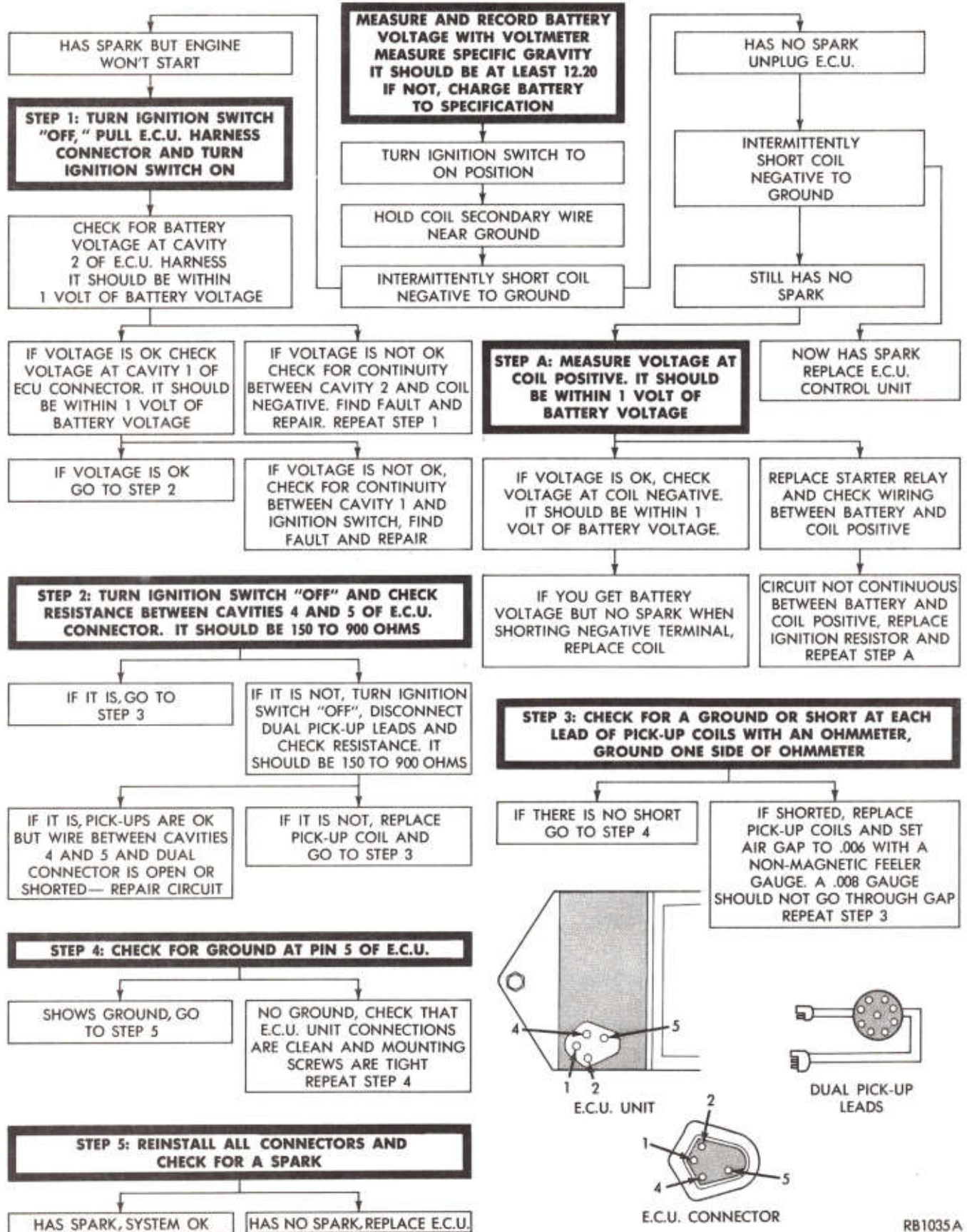


Fig. 5—Electronic Ignition Tester C-4503

ELECTRONIC IGNITION SYSTEM DIAGNOSIS



Tester cable and rotate Tester **Selector** switch to **Off** position.

(2) With ignition switch in "Off" position, remove screw attaching wiring harness connector to control unit and remove connector.

(3) Connect female lead of tester wiring harness to control unit and male lead of tester to disconnected lead from control unit. This puts tester into vehicle ignition system.

(4) Disconnect coil secondary wire from distributor cap center tower. Provide a 1/4 inch air gap from coil secondary wire to a good engine ground.

(5) Connect the Tester alligator type battery clips to the vehicle battery. Red clip to Battery, **Positive (+)** Terminal; Black clip to Battery, **Negative (-)** Terminal.

(6) Connect Adaptor alligator clip to ignition coil primary "Bat" terminal point. **CAUTION: Tester damage can result from erroneous connection of red test lead to coil primary "Ecu" terminal.**

Primary Position—Coil and Ballast Lamps

(1) Rotate Tester **Selector** switch to **Primary** position.

(a) Observe that **Coil** and **Ballast** lamps come **On**. All other lamps should remain **Off**.

(b) If **Green Coil** and **Ballast** lamps come **On**, primary circuit and ignition resistor are good. Proceed to next step.

Control Unit Position

(1) Rotate **Selector** switch to **Control Unit** position.

(a) Observe that **Control Unit Lamp** comes **On** and that a high voltage spark is present between coil secondary wire and a good engine ground. Observe length and intensity of spark as wire is slowly pulled away from engine ground to increase spark gap. A long blue spark indicates that coil output is good.

If **Green Control Unit** lamp comes **On**, and a good high intensity spark is present, proceed to next step.

(b) If **Green Control Unit** lamp does not come **On** or **No Ground** lamp does come **On**, refer to the **Diagnostic Chart** in tester instruction book.

Distributor Pick-Up Coil Position

(1) Rotate the **Selector** switch to **Distributor Pickup** position.

(2) Observe that **Distributor Pickup** lamp comes **On**. All other lamps should remain **Off**.

If the green **Distributor Pickup** lamp comes **On**, distributor pickup is good. Proceed to next Step.

If green **Distributor Pickup** lamp does not come **On**, refer to **Diagnostic Chart** in tester instruction book.

Ignition Switch Position—Run and Start Lamps

(1) Rotate **Selector** switch to **Ign Switch** position.

(a) Observe that both **Run** and **Start** lamps are **Off**.

(b) Place vehicle ignition switch in **On** or **Run** position and observe that only green **Run** lamp comes **On**.

(c) If green **Run** lamp does not come **On**, refer to **Diagnostic Chart** in tester instruction book.

(d) Turn vehicle ignition switch to **Start** position without cranking engine, and observe that green **Start** lamp comes **On**. Both **Run** and **Start** lamp should now be **On**.

(e) If both **Run** and **Start** lamps do not come **On**, refer to **Diagnostic Chart** in tester instruction book.

CAUTION: Do not leave tester in test mode with power on for extended periods of time.

DUAL PICK-UP START-RUN RELAY TEST (Fig. 6)

(1) Remove two way connector from pins 4 and 5 of dual pick-up start run relay.

(2) Using an ohmmeter touch pins 4 and 5, meter should read 20 to 30 ohms. If not replace relay.

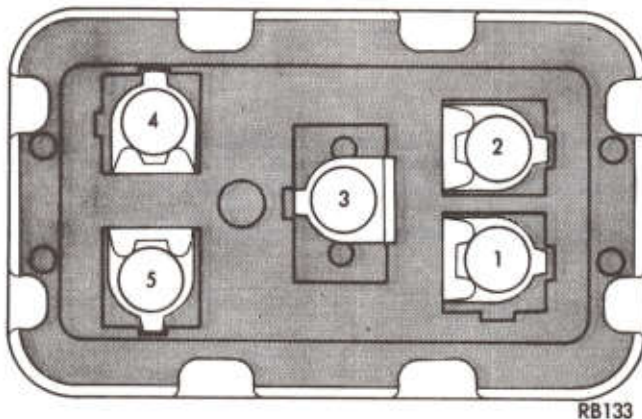


Fig. 6—Dual Pick-Up Start Run Relay

ELECTRONIC IGNITION TEST (WITHOUT TESTER)

Do not substitute this test if tester is available.

To properly test Electronic Ignition Systems, (Fig. 1) the tester C-4166 with adaptor, C-4166-1, C-4166-A or tester C-4503 with adaptor C-4503-3 should be used. But if they are not available, the system may be tested using a voltmeter with a 20,000 ohm/volt rating and an ohmmeter which uses a 9 volt battery for its operation. Both meters should be in calibration. When Ignition System problems are suspected, the following procedure should be followed:

(1) Visually inspect all secondary cables at (Fig. 2) coil, distributor and spark plugs for cracks and tightness.

(2) Check primary wire at the ignition coil and ballast resistor for tightness. If above checks do not

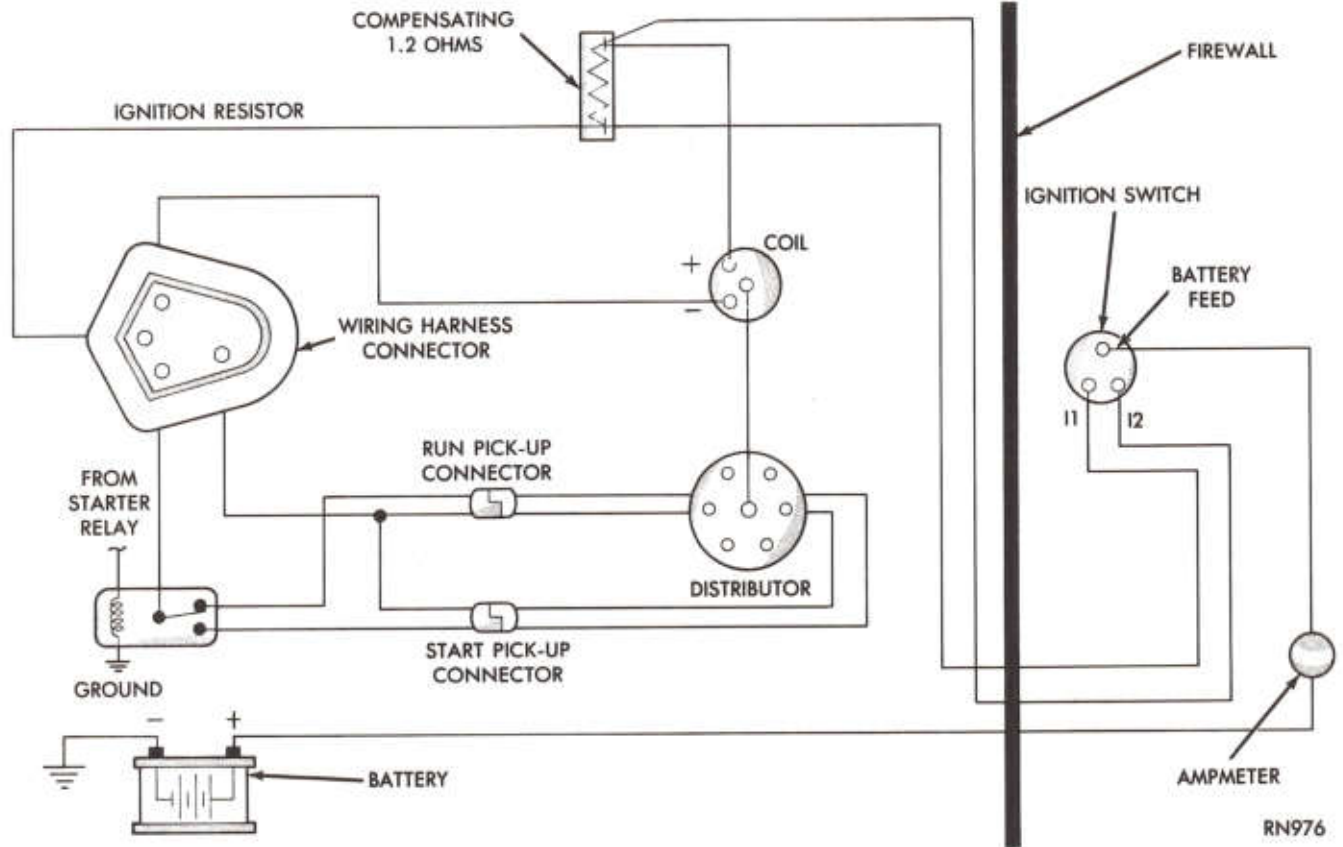


Fig. 1—Electronic Ignition System

determine problem, the following steps will determine if a **component** is faulty.

CAUTION: Whenever removing or installing wiring harness connector to control unit, ignition switch must be in the "Off" position.

(3) With a voltmeter measure voltage at battery and note it somewhere. Battery must be fully charged in order that it can deliver the necessary voltage to operate the cranking and ignition systems properly.

(4) Remove the coil secondary wire from distributor cap.

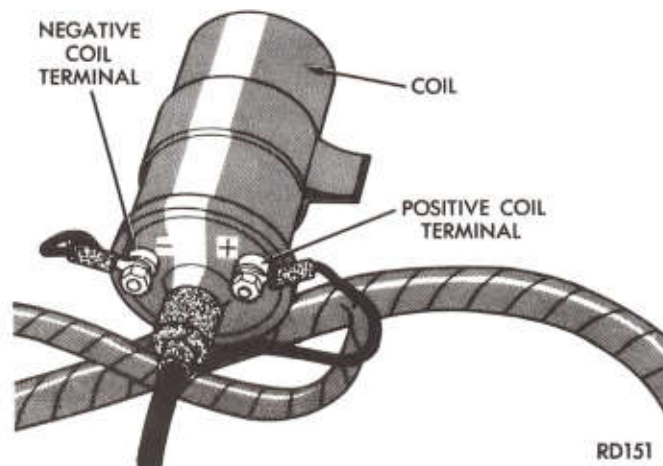


Fig. 2—Coil Terminals

(5) With key on, use special (Fig. 3) jumper wire and touch momentarily **negative (-)** terminal of coil to ground while holding coil secondary wire 1/4 inch (6mm) from a good engine ground. A spark should be obtained (Fig. 4).

(6) If spark was obtained go to Step (15).

(7) If no spark was obtained, go to next step.

(8) Turn key off and disconnect 4-wire harness going into **ECU** control unit.

(9) With key on, use special (Fig. 3) jumper wire and touch momentarily **negative (-)** terminal of coil to ground while holding coil secondary wire 1/4 inch (6mm) from a good engine ground. A spark should be obtained (Fig. 4). If a spark is obtained replace **ECU**.

(10) If no spark was obtained, measure voltage at coil positive terminal. It should be within one volt of

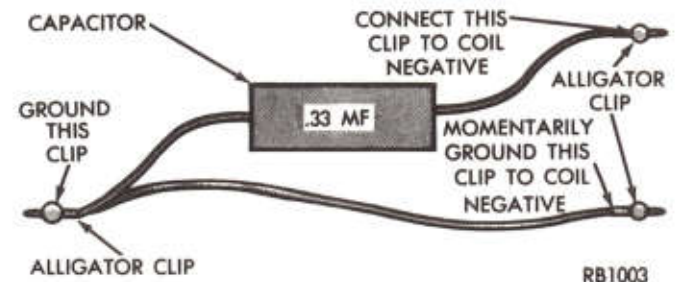
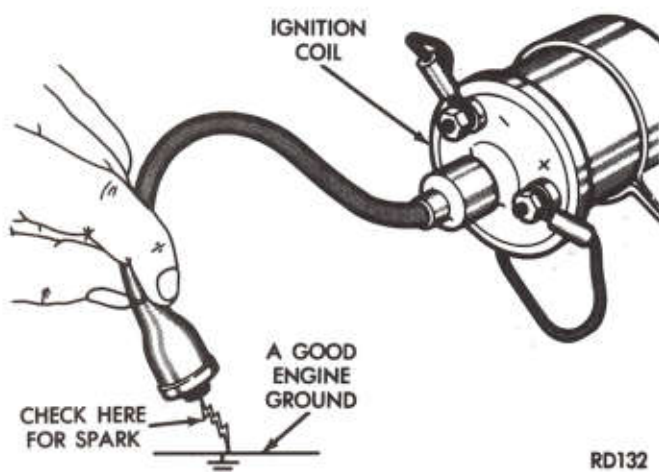


Fig. 3—Special Jumper to Ground Coil Negative



RD132

Fig. 4—Checking for Spark During Cranking

battery voltage. If battery voltage is obtained go to Step (13).

(11) If no battery voltage is obtained replace starter relay and check wiring between battery positive and coil (Fig. 5).

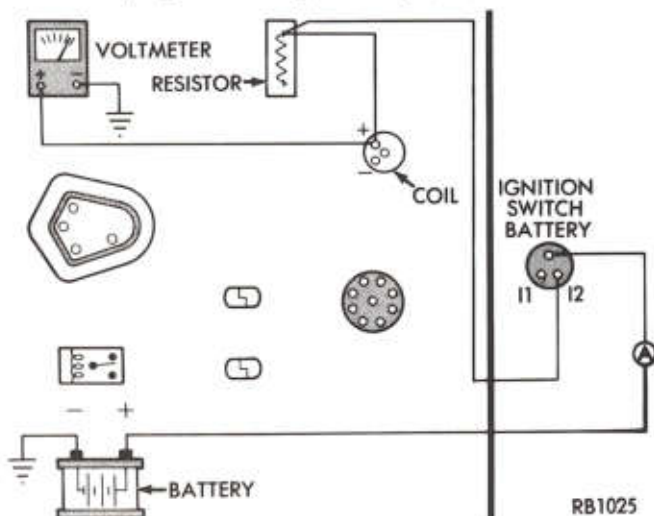
(12) If circuit is not continuous between battery and coil positive (Fig. 2 and 5) replace ignition resistor and repeat Step (10).

(13) Check battery voltage at coil negative. It should be within 1 volt of battery voltage (Fig. 6).

(14) If you get battery voltage but no spark when shorting negative terminal replace coil.

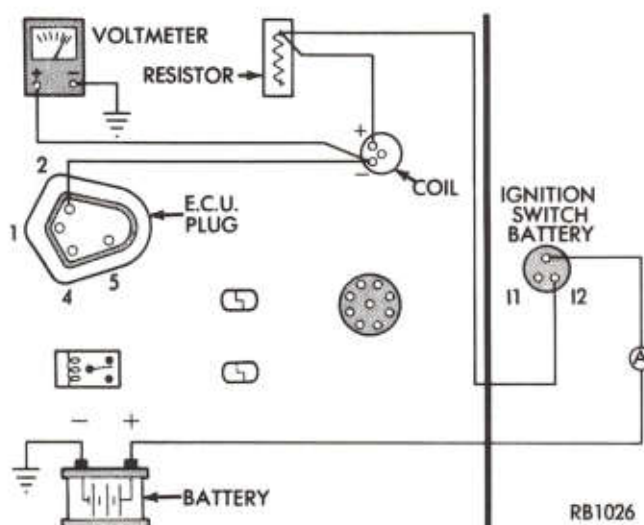
(15) If spark is obtained but engine will not start, turn ignition switch "off" and pull **ECU** harness connector off, turn ignition switch on and check for battery voltage at cavity 2 of **ECU** harness connector. It should be within 1 volt of battery voltage (Fig. 7).

(16) If no battery voltage is obtained turn ignition switch off and check for continuity between cavity 2 and coil negative (Fig. 8). If no continuity is obtained find fault, repair and repeat Step (15).



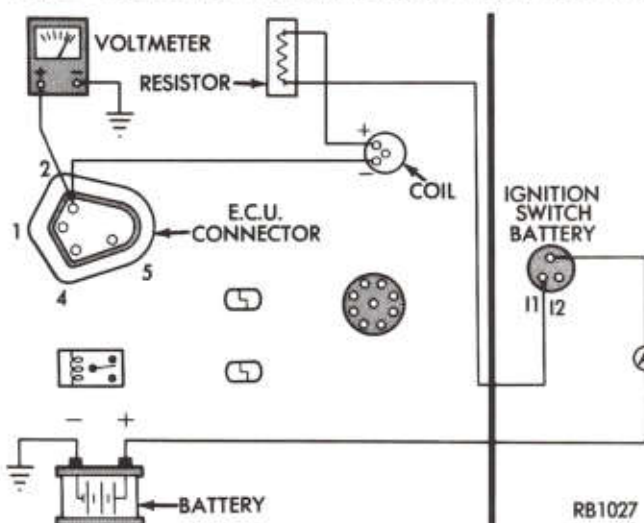
RB1025

Fig. 5—Testing for Battery Voltage at Coil Positive



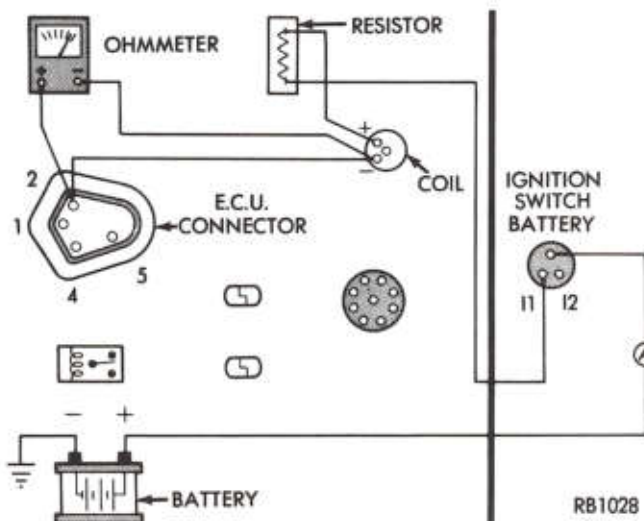
RB1026

Fig. 6—Testing for Battery Voltage at Coil Negative



RB1027

Fig. 7—Testing for Voltage at Cavity "2"



RB1028

Fig. 8—Checking Continuity Between Cavity "2" and Coil Negative

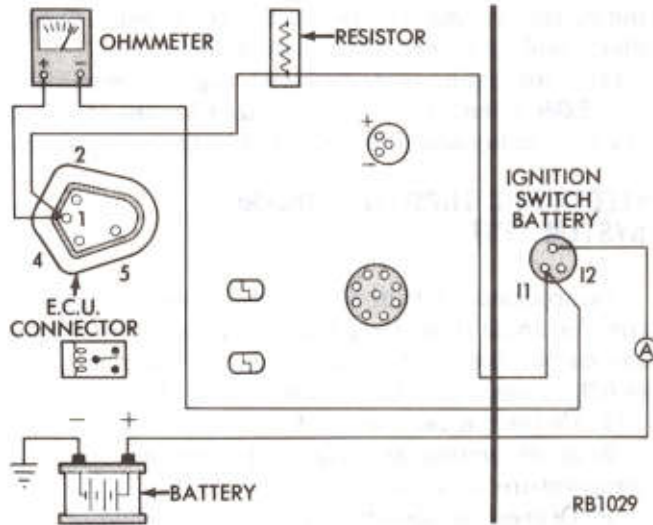


Fig. 9—Checking Continuity Between Cavity "1" and Ignition Switch

(17) If voltage is obtained check for battery voltage at cavity 2 of ECU harness connector. If battery voltage is obtained go to Step (19) (Fig. 7).

(18) If no battery voltage is obtained turn ignition off and check for continuity between cavity 1 and ignition switch. Find fault and correct (Fig. 9).

(19) If voltage is obtained in Step (17) turn ignition switch off and with an ohmmeter check resistance between cavities 4 and 5 of ECU harness connector (Fig. 10). It should be between 150 and 900 ohms. If it is go to Step (21).

(20) If resistance is not between 150 and 900 ohms, disconnect pick-up leads. Measure resistance, it should be 150 to 900 ohms (Fig. 11). If it is not pick-up coil(s) are bad, replace and go to Step (22).

(21) If resistance is between 150 and 900 pick-up coils are good but wires between cavities 4 and 5 are open or shorted, or dual pick-up start-run relay is bad.

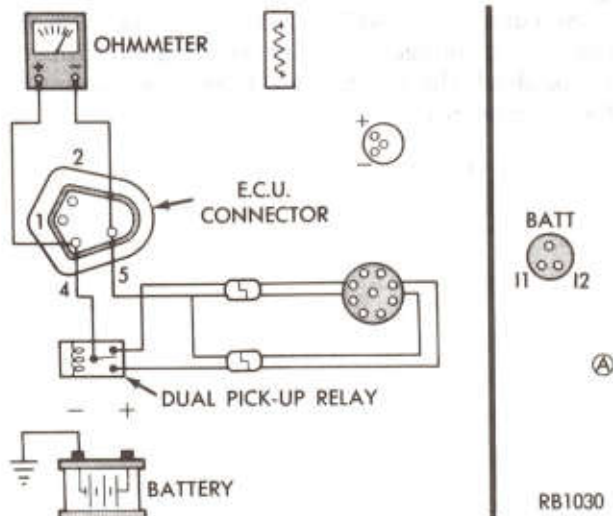


Fig. 10—Checking Resistance Between Cavities "4" and "5"

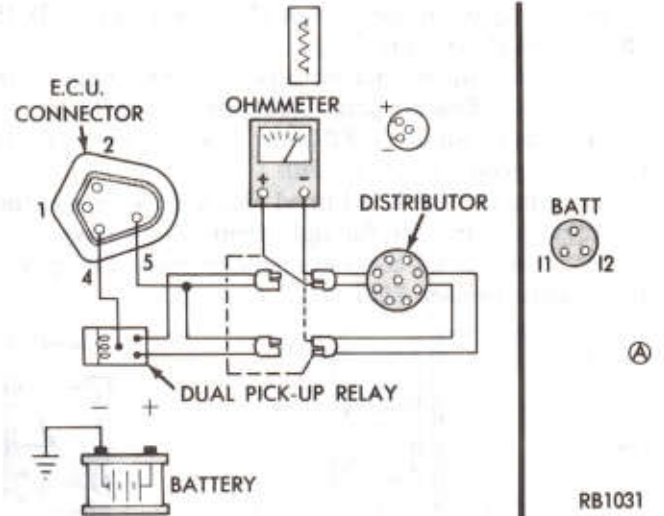


Fig. 11—Testing Resistance of Both Pick-Up Coils

Repair wires and/or test dual pick-up start-run relay. See testing dual pick-up start-run relay this group.

(22) Check for short at each lead of pickups with an

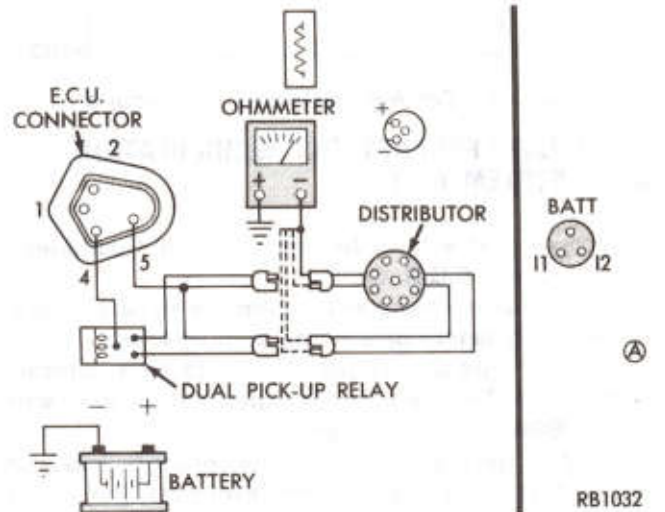


Fig. 12—Testing for Short at Each Pick-Up Coil Terminal

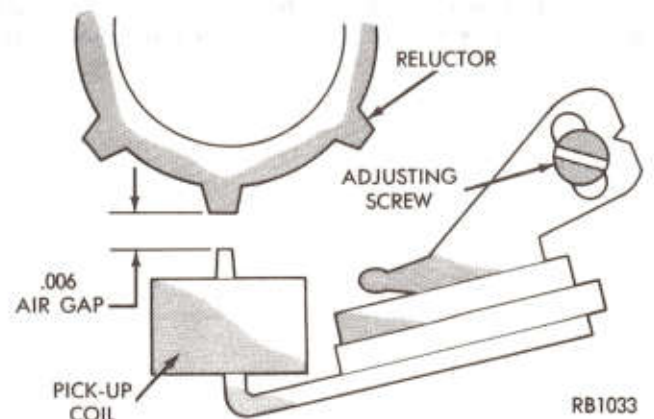


Fig. 13—Pick-Up Coil Air Gap

ohmmeter (ground one side of ohmmeter) (Fig. 12). If there is no short go to Step (24).

(23) If pick-up is shorted replace it and adjust air gap (Fig. 13). **See air gap adjustment** this group.

(24) Check pin 5 of **ECU** for ground (Fig. 14). If ground is good go to Step (26).

(25) If no ground is obtained check **ECU** for poor or dirty connections and for tight mounting screws.

(26) Reinstall all connections and check for spark. If no spark replace **ECU**.

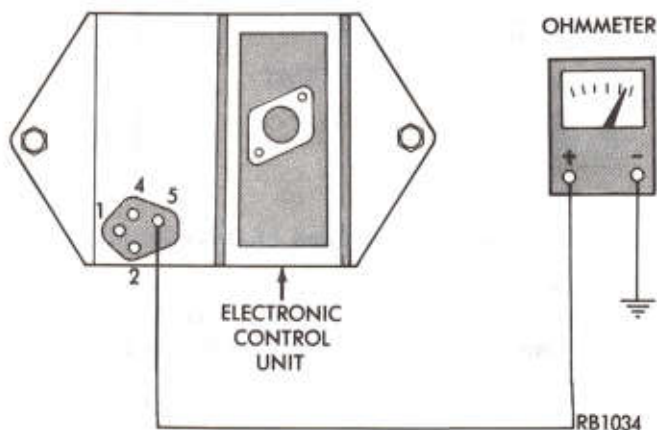


Fig. 14—Testing ECU Pin 5 for Ground

ELECTRONIC EXHAUST GAS RECIRCULATION (EGR) SYSTEM TEST

Incorporated within the Spark Control Computer is the Electronic **E.G.R.** Control.

(1) The engine temperature sensors must be working properly before proceeding with this test.

(2) With engine temperature cold and ignition switch turned off connect a voltmeter to the gray wire on the **EGR** solenoid and ground.

(3) Start the engine. The voltage should be less than one volt. It will remain at this level until the engine has reached its normal operating temperature and the electronic **E.G.R.** schedule has timed out. The solenoid will then de-energize and the voltmeter will read charging system voltage. If not, replace the solenoid and repeat this step. If the voltmeter indicates charg-

ing system voltage before the **E.G.R.** schedule is complete, replace externally mounted timer.

(4) If an engine is started with engine temperature hot, **EGR** solenoid will be energized for the length of the time delay schedule only. It will then de-energize.

ELECTRONIC THROTTLE CONTROL SYSTEM TEST

Incorporated within the spark control computer is the electronic throttle system. A solenoid mounted on the carburetor is energized when the air conditioner (**A/C**), or electronic timers are activated.

(1) Connect a tachometer to engine.

(2) Start engine and run until normal operating temperature is reached.

(3) Depress accelerator and let up. A higher than curb idle speed should be seen for the length of the **E.G.R.** schedule.

(4) On vehicles equipped with/and turning on the **A/C** and depressing the accelerator for a moment should give a higher than curb idle speed. Turning **A/C** off will produce the normal idle speed. **The A/C clutch will cycle on and off as it is running. This should not be mistaken as part of the electronic control.**

(5) If speed increases do not occur, disconnect the three way connector at the carburetor.

(6) Check the solenoid with an ohmmeter by measuring the resistance from the terminal that contained the black wire to ground. The resistance should be between 15 and 35 ohms. If it is not replace the solenoid.

(7) Start the vehicle and before the delay has timed out, measure the voltage of the black wire of the three way connector. The voltmeter should read charging system voltage, if it does not replace the start timer (gray).

(8) Turning the **A/C** on should also produce charging system voltage after the time delay has timed out. If not check the wiring back to the instrument panel for an open circuit.

SERVICE PROCEDURES

INDEX

	Page		Page
Air Gap Adjustment	31	Secondary Circuit Inspection	25
Dual Pick-Up Distributor	31	Distributor Cap	25
Run Pick-Up	32	Distributor Rotor	25
Start Pick-Up	31	Spark Plug Cables	25
Single Pick-Up Distributor	31	Shaft and Bushing Wear Test	29
Assembling the Distributor		Spark Plugs	26
8 Cylinder Dual or Single Pick-Up (ECU)	30	Spark Plug Conditions	27
Cable Resistance Chart	26	Cleaning and Regapping	27
Centrifugal Advance Curve	32	Cold Fouling	27
Disassembling the Distributor		High Speed Miss	27
8 Cylinder Dual or Single Pick-Up (ECU)	30	Lead Deposits	27
Distributor Installation	29	Normal Conditions	27
Distributor Removal	29	Oil and Ash Incrusted	27
Idle RPM Test	28	Overheating	27
Ignition Coil	32	Wet Fouling	27
Ignition Timing Procedure	28	Vacuum Advance Curve	32
Pick-Up Coil Replacement	31	Vacuum Diaphragm Leak Test	32

SECONDARY CIRCUIT INSPECTION

Distributor Cap

Remove distributor cap and inspect inside for flash-over, cracking of carbon button, or cracking of cap. If any of these conditions are present distributor cap should be replaced.

Light scaling of terminals, caused by arcing of spark from the rotor is normal, and does not affect operation.

A cap that is greasy or dirty or has a powdered like substance on the inside should be cleaned with a solution of warm water and a mild detergent. Scrub with a soft brush, thoroughly rinse, and dry with a clean soft cloth.

Distributor Rotor

Inspect rotor for cracks and improper tension of spring terminal. If either of these conditions are present rotor should be replaced.

A black silicone varnish covers tip 0.2 to 0.3 in. (.5mm to .8mm) of rotor electrode replacing earlier silicone grease. Both type of coverage are for the purpose of suppressing electro magnetic radiation

(EMR). Grease will darken with age, has an ashlike appearance and should not be removed. Ash formation on both types of coverage is normal and does not affect engine performance.

Spark Plug Cables

Check high tension cable connections for good contact at coil and distributor cap towers and at spark plugs. Terminals should be fully seated. Nipples and spark plug covers should be in good condition. Nipples should fit tightly on coil cap towers and spark plug cover should fit tight around spark plug insulators. Cable connections that are loose will corrode and increase in resistance and permit water to enter towers causing ignition malfunction. **To maintain proper sealing between towers and nipples, cable and nipple assemblies should not be removed from distributor or coil towers unless nipples are damaged or cable testing indicates high resistance or broken insulation.**

Clean high tension cables with a cloth moistened with a non-flammable solvent and wipe dry. Check for brittle or cracked insulation.

When testing secondary cables for punctures and

cracks with an oscilloscope follow the instructions of the equipment manufacturers.

If an oscilloscope is not available, secondary cables can be tested as follows:

CAUTION: On catalytic converter equipped vehicle do not leave any one spark plug wire disconnected any longer than necessary during test or possible heat damage to catalytic converter will occur. Total test time must not exceed ten minutes.

(a) Engine not running, connect one end of a test probe to a good ground, other end free for probing.

(b) With engine running, move test probe along entire length of ignition cables. If punctures or cracks are present there will be a noticeable spark jump from faulty area to probe. Secondary coil cable may be checked in the same manner. Be sure one spark plug cable is disconnected from spark plug while running probe along coil wire secondary cable. Cracked, leaking or faulty cables should be replaced.

When installing new cable assemblies, install new high tension cable and nipple assembly over cap or coil tower, entering terminal into tower, push lightly, then pinch large diameter of nipple (Fig. 1) to release trapped air between nipple and tower. Continue pushing on cable and nipple until cables are properly seated in cap towers. Use same procedure to install cable in coil tower (Fig. 2). Wipe spark plug insulator clean before reinstalling cable and cover.

Use following procedure when removing high tension cable from spark plug. First, remove cable from retaining bracket. Then grasp insulator as close as possible to spark plug, rotate slightly and use a straight and steady pull. **Do not use pliers and do not pull cable at an angle.** Doing so will damage insulation, cable terminal or spark plug insulator. **Wipe spark plug insulator clean before reinstalling cable and cover.**

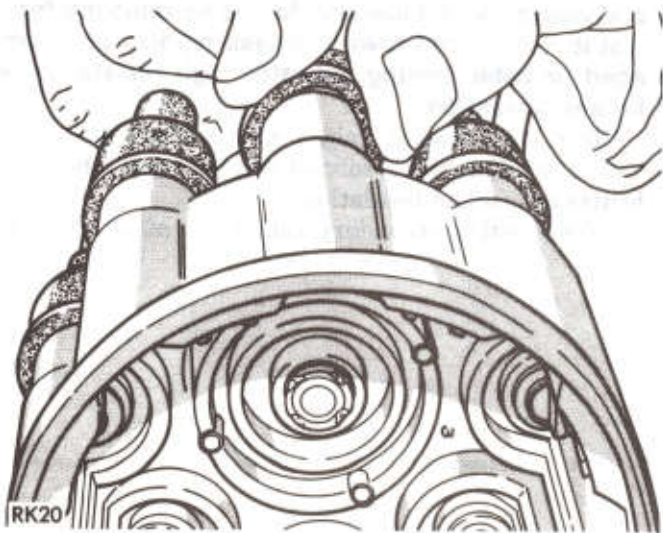


Fig. 1—Installing Secondary Cable and Nipple at Distributor Cap

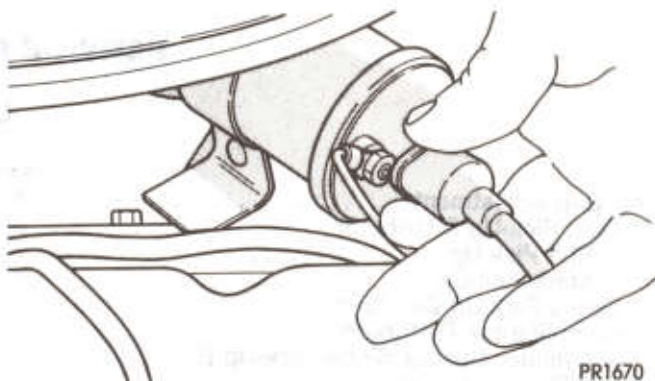


Fig. 2—Installing High Tension Cable and Nipples at Coil Tower

Resistance type cable is identified by the words **Electronic Suppression** printed on cable jacket.

Use an ohmmeter to check resistance type cable for open circuits, loose terminals or high resistance as follows:

- Remove cable from spark plug.
- Lift distributor cap from distributor with cables intact. **Do not remove cables from cap.**
- Connect ohmmeter between spark plug end terminal and corresponding electrode inside cap, making sure ohmmeter probes are in good contact. Resistance should be within tolerance shown in cable resistance chart. If resistance is not, remove cable at cap tower and check the cable. If resistance is still not within tolerance, replace assembly. Test all spark plug cables in the same manner.

CABLE RESISTANCE CHART	
Minimum	Maximum
250 Ohms Per Inch	600 Ohms Per Inch
3000 Ohms Per Foot	7200 Ohms Per Foot

To test coil to distributor cap high tension cable, remove distributor cap with cable intact. **Do not remove cable from the cap.** Connect ohmmeter between center contact in cap and other end of either primary terminal of the ignition coil. Resistance should be within tolerance shown in resistance chart. If resistance is not, remove cable at coil tower and check cable resistance. If resistance is still not within tolerance, replace cable. Also check for a loose connection at tower or for a faulty coil.

Inspect coil tower for cracks, carbon tracking or oil leaks.

SPARK PLUGS

Resistor spark plugs are used in all engines, resistance values of 7,500 to 15,000 ohms.

Spark Plug Conditions

Spark plug appearance or conditions can reflect a wide variety of engine conditions as follows:

Normal Conditions

Normal conditions (Fig. 3 left). This plug has been running at correct temperature in a "healthy" engine. The few deposits present will probably be light tan or gray in color with most regular grades of commercial gasoline. Electrode burning will not be in evidence; gap growth will average not more than about .001 in./1000 miles (0.3mm/1600km). Chances are the plug, as pictured, could be cleaned, gap electrodes filed, regapped and reinstalled with good results.

Cold Fouling

Cold fouling or carbon deposits (Fig. 3 right). This dry black appearance is fuel carbon and can be due to over rich fuel-air mixture, possibly resulting from a faulty choke, clogged air cleaner, improper carburetor idle adjustment, or dirty carburetor. However, if only one or two plugs in a set are fouled like this it is a good idea to check for worn or improperly installed valve guide seals, or faulty ignition cables. This condition also results from prolonged operation at idle.

Wet Fouling

Wet fouling (Fig. 4 left) tells you that plug has drowned in excess oil. In an old engine, suspect worn rings or excessive cylinder wear. **Remember that "break-in" fouling of new engines may occur before normal oil control is achieved. In new or recently overhauled engines, such fouled plugs can be cleaned and reinstalled.**

Overheating

Overheating (Fig. 4 right) is indicated by a white or light gray insulator which appears "blistered". Electrode wear rate will be considerably in excess of .001 in./1000 miles (.03mm/1600km). Over-advanced ignition timing, detonation and cooling system stoppages can overheat spark plug.

Oil and Oil Ash Incrusted (Fig. 5)

If one or more plugs are oil or oil ash incrustrated,

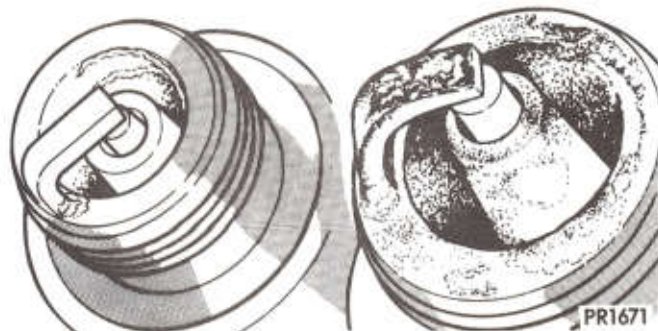


Fig. 3—Normal and Cold Fouling

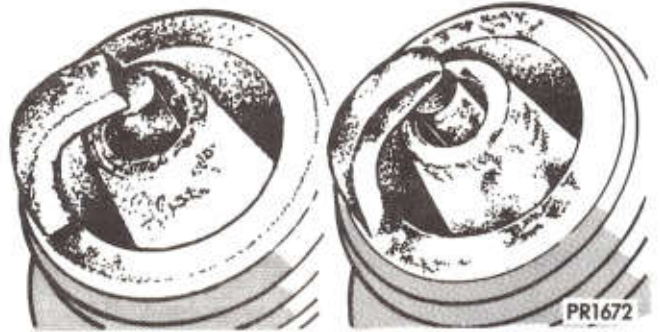


Fig. 4—Wet Fouling and Overheating

engine should be evaluated for true cause of oil entry into combustion chamber.

Lead Deposits

Lead deposits are the result of using leaded gasoline.

High Speed Miss

When replacing spark plugs because of a high speed miss condition; **Wide open throttle operation must be avoided for approximately 50 miles (80km) after installation of new plugs.**

This will allow deposit shifting in combustion chamber to take place gradually and avoid plug destroying splash fouling shortly after plug change.

Cleaning and Regapping

Carefully clean spark plugs in an abrasive type cleaner. Use a pin type feeler gauge to check spark plug gap. Reset gaps to Specifications. **Before setting spark plug gap, file center electrode flat, make**

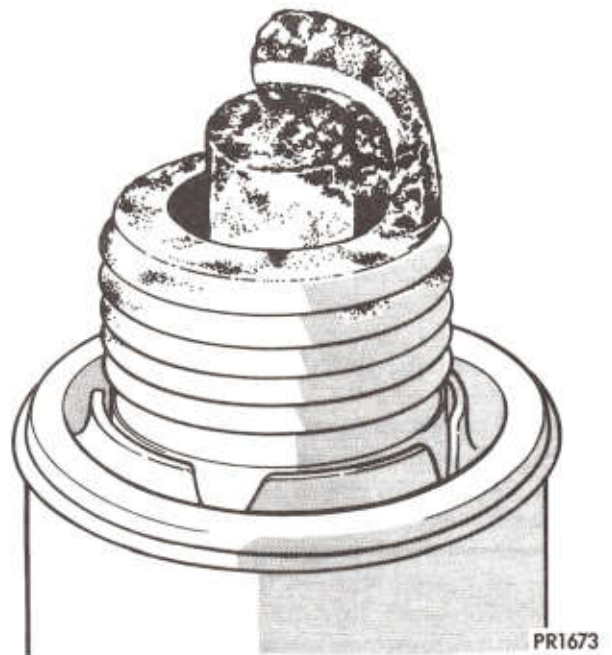


Fig. 5—Oil or Ash Incrusted

adjustment by bending ground (side) electrode, never bend the center electrode.

When installing spark plugs, first clean dirt and grit from spark plug seats, tighten to 30 ft. lbs. (41 N.m).

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TESTS.

IDLE RPM TEST

Engine idle set rpm should be tested and recorded as it is when the vehicle is first brought into shop for testing. This will assist in diagnosing complaints of engine stalling, creeping and hard shifting on vehicles equipped with automatic transmissions. See **Fuel System Group 14** for procedure to be followed.

Test procedures are as follows:

(1) Connect red lead of test tachometer unit to negative primary terminal of coil and black lead to a good ground.

(2) Turn selector switch to the appropriate cylinder position of engine being tested (8 cylinder).

(3) Turn tachometer rpm switch to 1000 rpm position.

(4) With engine at normal operating temperature (off fast idle), momentarily open the throttle and release to make sure there is no bind in the linkage and that idle speed screw is against its stop.

(5) Note engine rpm on 1000 rpm scale and adjust curb idle to specifications. See "Fuel System" specifications.

On engines equipped with idle speed solenoid, solenoid must be energized. Adjust curb rpm with idle set adjusting screw resting on solenoid plunger.

IGNITION TIMING PROCEDURE

To obtain optimum engine performance, distributor must be correctly positioned on engine to give proper ignition timing.

Test procedures are as follows:

(1) Connect a suitable **Power Timing Light** to number one cylinder (refer to equipment manufacturer's instructions for correct connecting procedures) or a suitable magnetic timing unit (use a 10° offset when required).

Do not puncture cables, boots or nipples with test probes. Always use proper adapters. Puncturing spark plug cables with a probe will damage cables. Probe can separate conductor and cause high resistance. In addition breaking rubber insulation may permit secondary current to arc to ground.

(2) Connect red lead of test tachometer unit to negative primary terminal of the coil and black lead to a good ground.

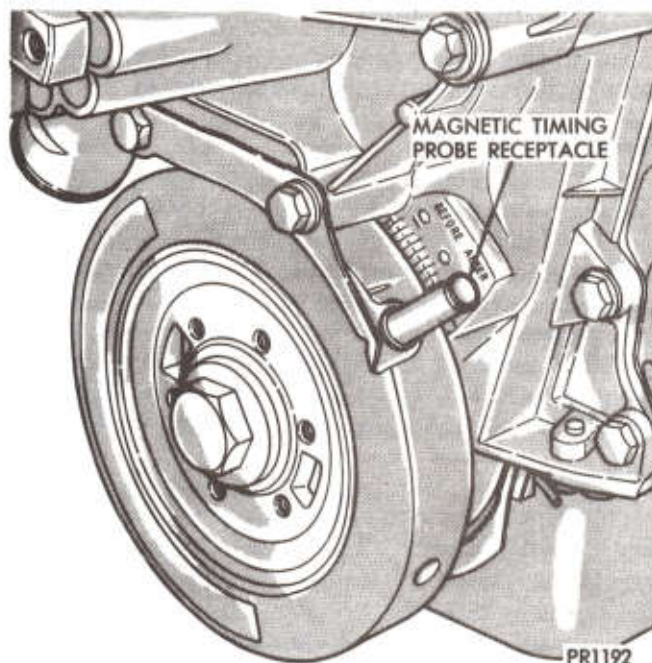


Fig. 6—Magnetic Timing Probe Receptacle 8 Cylinder Engine

(3) Turn selector switch to appropriate cylinder position.

(4) Start engine, set parking brake, place transmission in neutral and run until normal operating temperature is obtained.

(5) With engine at normal operating temperature (off fast idle), momentarily open throttle and release to make sure there is no bind in linkage and that idle speed screw is against its stop.

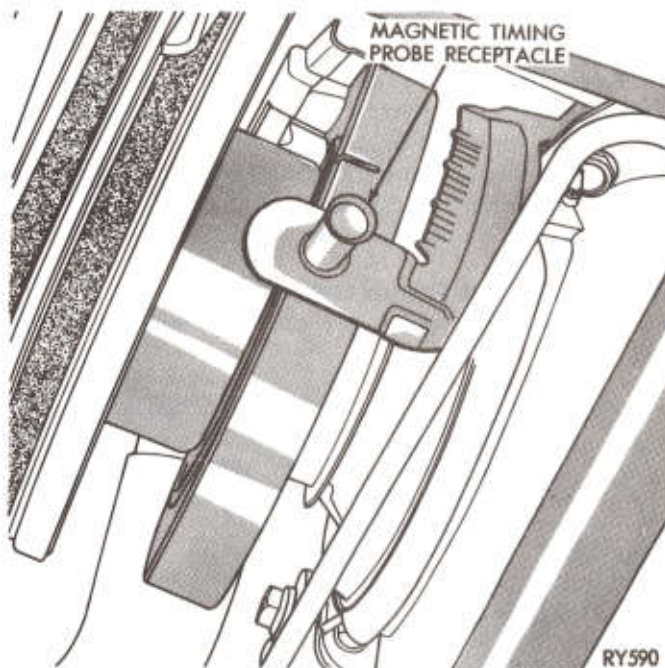


Fig. 7—Bottom Mounted Magnetic Timing Probe Receptacle 8 Cylinder Engine

- (6) Disconnect and plug vacuum line at distributor.
- (7) Read engine rpm on 1000 rpm scale. If engine rpm is at or below curb idle specified on label, proceed to next step. If it is higher, turn idle speed screw until specified curb idle rpm is reached.

(8) Aim power timing light at timing plate on chain case cover (Figs. 6 and 7) or read magnetic timing unit. If timing is within $\pm 2^\circ$ of value specified on label, proceed to Step (9). If outside of specified tolerance, proceed to next step.

(9) Loosen distributor hold-down arm screw just enough so distributor housing can be rotated in its mounting. Turn distributor housing until specified label value is reached.

If lamp flash occurs when timing mark on vibration damper is located before specified degree mark on timing plate in direction of engine rotation, timing is advanced. To adjust, turn distributor housing in direction of rotor rotation.

If flash occurs when vibration timing mark is located after specified degree mark in direction of engine rotation, timing is retarded.

CAUTION: Do not use distributor vacuum advance chamber as a turning handle when turning distributor.

(10) Tighten distributor hold-down arm screw after timing has been set and recheck **Curb Idle rpm** and the timing. If both **Curb Idle rpm** and timing are within specifications, timing is correct. If engine rpm is not at or below curb idle rpm shown on label, reset engine rpm and recheck timing. Repeat above until both engine rpm and timing are acceptable.

(11) Remove timing lamp or magnetic timing unit. If an "Idle Speed Adjustment" is being performed, proceed to that section in **Fuel System, Group 14**. If not, proceed to next step.

(12) If curb idle rpm is not within ± 50 rpm of value shown on label readjust curb idle rpm. Do not reset timing.

(13) Turn engine off. Unplug and reconnect vacuum line at distributor, if disconnected. Remove jumper wire (if installed) and tachometer.

DISTRIBUTOR REMOVAL

8 Cylinder

- (1) Disconnect vacuum hose at distributor vacuum control unit.
- (2) Disconnect distributor pickup lead wire(s) at wiring harness connectors.
- (3) Unfasten distributor cap retaining clips and lift off distributor cap.
- (4) Scribe a mark on the edge of distributor housing to indicate position of rotor as reference when reinstalling distributor.
- (5) Remove distributor hold down clamp screw and clamp.
- (6) Carefully lift distributor from engine.

DISTRIBUTOR INSTALLATION

8 Cylinder

(1) Position distributor in engine. Make sure rubber O-ring seal is in groove of distributor housing. Align rotor with marks previously scribed on distributor housing. **Clean top of cylinder block to insure a good seal between distributor base and block.**

(2) Engage tongue of distributor shaft with slot in distributor oil pump drive gear. **If engine has been cranked while distributor is removed, it will be necessary to establish the proper relationship between distributor shaft and No. 1 piston position as follows:**

(a) Rotate crankshaft until number one piston is at top of compression stroke. Mark on crankshaft vibration damper should be in line with "O" Tdc mark on timing chain case cover.

(b) Rotate rotor to position of number one distributor cap terminal.

(c) Lower distributor into opening, connect pickup coil leads and install distributor cap. Make sure all high tension wires "snap" firmly in cap towers. Install distributor hold-down clamp screw. Tighten screw finger tight.

(3) Connect distributor pickup lead wire(s) at wiring harness connectors.

(4) Connect vacuum hose on non **ESA** vehicles to distributor governor.

(5) Adjust engine timing to Specification (refer to "Ignition Timing").

SHAFT AND BUSHING WEAR TEST

(1) Remove distributor (refer to "Distributor Removal").

(2) Remove distributor rotor. Use two screwdrivers under upper part of rotor to pry off.

(3) Clamp distributor in a vise equipped with soft jaws and apply only enough pressure to restrict any movement of the distributor during test.

(4) Attach a dial indicator to distributor housing so indicator plunger arm rests against reluctor.

(5) Place one end of a wire loop around the reluctor sleeve just above the reluctor.

(6) Hook a spring scale in the other end of wire loop.

The wire loop must be down against top of reluctor to insure a straight pull; also be sure that wire loop does not interfere with indicator or indicator holding bracket.

(7) Apply a 1-1/2 lb. (7N) pull toward dial indicator and a one lb. (4N) pull away from indicator and read total movement of plunger on indicator dial. If total indicator movement exceeds .006 inch (0.15mm) replace distributor housing or shaft assembly, (refer to "Distributor Disassembly").

DISASSEMBLING DISTRIBUTOR

8 Cylinder Dual or Single Pick-Up ECU Distributor (Fig. 8)

(1) Remove distributor rotor. Use two screwdrivers under upper part of rotor to pry off.

(2) Remove two screws and lockwashers attaching vacuum control unit to distributor housing, disconnect vacuum control arm from upper plate, and remove control if so equipped.

(3) Remove reluctor by prying up from bottom of reluctor with two pry bars, or screwdrivers (maximum width 7/16 inch 11mm). Be careful not to distort or damage teeth on reluctor.

(4) Remove two screws and lockwashers attaching lower plate to housing and lift out lower plate, upper plate, and pick-up coil as an assembly.

Distributor cap clamp springs are held in place by peened metal around the openings and should not be removed.

If side play exceeded .006 (0.15mm) inch in "Shaft and Bushing Wear Test" replace housing, shaft, reluctor sleeve, and governor weights as an assembly as follows:

(a) Remove distributor shaft retaining pin and slide retainer off end of shaft.

(b) Use a file to clean burrs, from around pin hole in shaft and remove lower thrust washer.

(c) Push shaft up and remove shaft through top of distributor body.

ASSEMBLING DISTRIBUTOR

8 Cylinder Dual or Single Pick-Up ECU Distributor (Fig. 8)

(1) Test operation of governor weights and inspect weight spring for distortion if so equipped.

(2) Lubricate governor weights.

(3) Inspect all bearing surfaces and pivot pins for roughness, binding or excessive looseness.

(4) Lubricate and install upper thrust washer (or washers) on the shaft and slide shaft into distributor body.

(5) Install distributor shaft retainer and pin.

(6) Install lower plate, upper plate and pick-up coil assembly and install attaching screws.

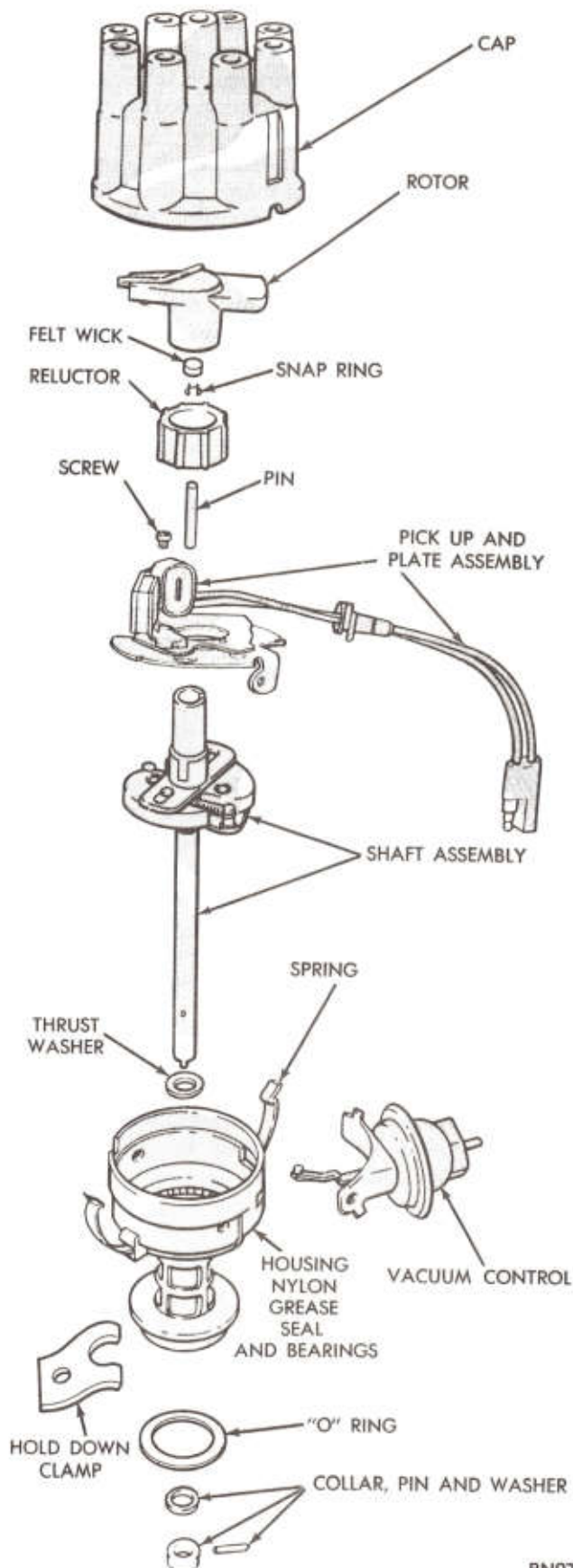
(7) Attach vacuum advance unit arm to pick-up plate if so equipped.

(8) Install vacuum unit attaching screws and washers.

(9) Position reluctor keeper pin into place on reluctor sleeve.

(10) Slide reluctor down reluctor sleeve and press firmly into place.

(11) Lubricate felt pad in top of reluctor sleeve with 1 drop of light engine oil and install the rotor.



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Fig. 8—Eight Cylinder ECU Distributor (Exploded View Single Pick-Up Shown)

PICK-UP COIL REPLACEMENT

Removal

- (1) Remove distributor.
- (2) Remove reluctor by prying up from bottom with two pry bars or screw drivers maximum blade width 7/16 in. (11mm).

CAUTION: Be careful not to damage reluctor teeth.

- (3) Remove two screws attaching vacuum control unit to distributor housing if so equipped.
- (4) Disconnect vacuum control arm from plate and remove control unit if so equipped.
- (5) Remove pick-up coil leads from distributor housing.
- (6) Remove two screws attaching plate to distributor housing.
- (7) Lift out plate, and pick up as an assembly from housing.

(8) Remove plate and pick-up coil assembly by depressing retainer clip on underside and moving it away from attaching stud.

Pick-up coil is not removable from plate. They are serviced as an assembly.

Installation

- (1) Place a small amount of distributor cam lubricant on plate support pins.
- (2) Position plate, install retainer clip, depress and lock into place.
- (3) Position plate and pick-up coil assembly in distributor housing, install mounting screws and tighten securely.
- (4) Attach vacuum control arm to plate, position control into place on distributor housing, install mounting screws and tighten securely if so equipped.
- (5) Install pick up coil leads to distributor housing.
- (6) Install reluctor. Refer to "Assembling the Distributor" for correct installation procedures.
- (7) Install distributor.

AIR GAP ADJUSTMENT

Single Pick-up Distributor (Fig. 9)

- (1) Align one reluctor tooth with pick up coil tooth.
- (2) Loosen pick up coil hold down screw.
- (3) Insert .006" (0.15mm) **non-magnetic** feeler gauge between reluctor tooth and pick up coil tooth.
- (4) Adjust air gap so that **contact** is made between reluctor tooth, feeler gauge, and pick up coil tooth.
- (5) Tighten hold down screw.
- (6) Remove feeler gauge. **No force should be required in removing feeler gauge.**
- (7) Check air gap with .008" (0.20mm) feeler gauge. A .008" (0.20mm) feeler gauge should not fit into air gap.

CAUTION: A .008" (0.20mm) feeler gauge can be forced into air gap. Do not force feeler gauge into air gap.

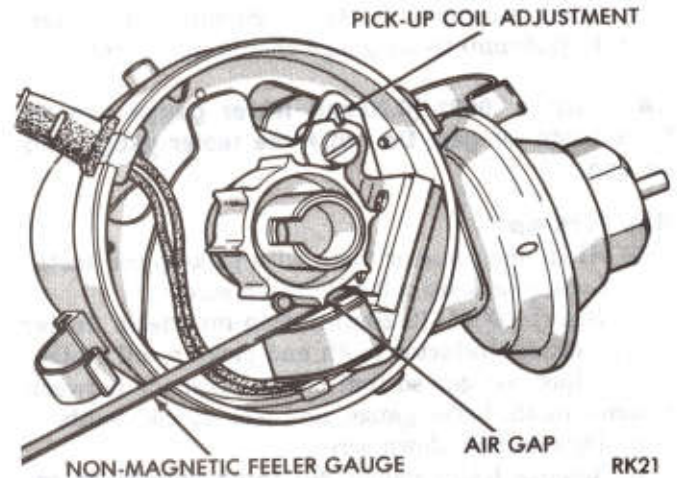


Fig. 9—Air Gap Adjustment Single Pick-Up (8 Cylinder Shown)

Dual Pick-up Distributor (Fig. 10)

In dual pickup distributors start pickup is identified by a two prong male connector. The run pickup is identified by a male and female plug.

Start Pick-up

- (1) Align one reluctor tooth with pick-up coil tooth.
- (2) Loosen pick-up coil hold down screw.
- (3) Insert .006" (0.15mm) **non-magnetic** feeler gauge between reluctor tooth and pick-up coil tooth.
- (4) Adjust air gap so that contact is made between reluctor tooth, feeler gauge, and pick-up coil tooth.
- (5) Tighten hold down screw.
- (6) Remove feeler gauge. **No force should be required in removing feeler gauge.**

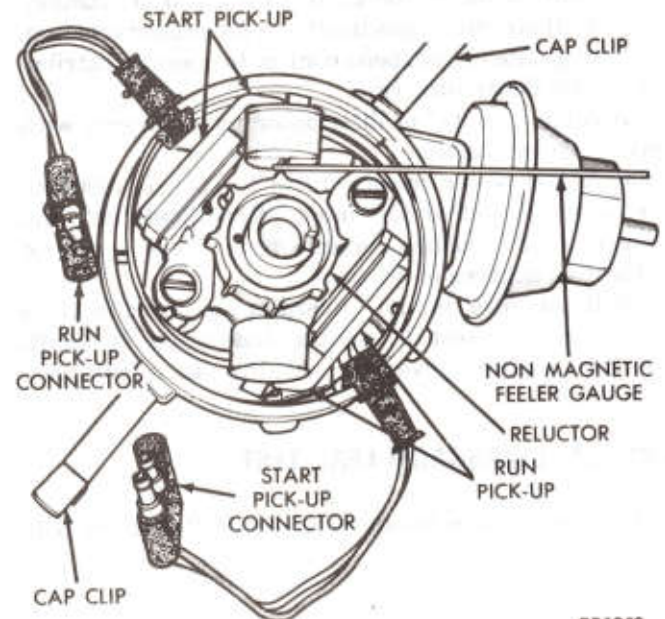


Fig. 10—Air Gap Adjustment Dual Pick-Up (8 Cylinder Shown)

(7) Check air gap with .008" (0.20mm) feeler gauge. A .008" (0.20mm) feeler gauge should not fit into air gap.

CAUTION: A .008" (0.20mm) feeler gauge can be forced into air gap. Do not force feeler gauge into air gap.

Run Pick-up

- (1) Align one reluctor tooth with pick-up coil tooth.
- (2) Loosen pick up coil hold down screw.
- (3) Insert .008" (0.20mm) **non-magnetic** feeler gauge between reluctor tooth and pick-up coil tooth.
- (4) Adjust air gap so that contact is made between reluctor tooth, feeler gauge, and pick-up coil tooth.
- (5) Tighten hold down screw.
- (6) Remove feeler gauge. **No force should be required in removing gauge.**

(7) Check air gap with .010" (0.25mm) feeler gauge. A .010" (0.25mm) feeler gauge should not fit into air gap.

CAUTION: A .010" (0.25mm) feeler gauge can be forced into air gap. Do not force feeler gauge into air gap.

CENTRIFUGAL ADVANCE CURVE

Carefully mount distributor assembly (less cap and rotor) in a reliable stroboscope-type distributor tester.

It is important that **appropriate adapter** for checking electronic type distributors is connected to distributor stand and that instructions for its usage are followed. After this is done proceed with test as follows:

- (1) Turn selector switch to 6 or 8 cylinder position and motor switch to the correct direction of rotation. Refer to Distributor Specifications for proper rotation.
- (2) Regulate tester speed control to operate distributor at 200 distributor rpm.
- (3) Align the "O" of distributor tester degree with any of arrow flashes.
- (4) Adjust tester speed control to operate distributor at speeds called for under "**Specifications**" and observe arrow flashes opposite tester degree ring to determine degrees of advance.
- (5) If advance is not according to specifications replace with correct distributor shaft assembly (shaft, reluctor sleeve, governor weights as a complete assembly).

VACUUM DIAPHRAGM LEAK TEST

With distributor mounted in distributor tester with

vacuum unit attached to distributor, proceed as follows:

- (1) Place thumb over end of vacuum pump and hose and adjust regulator control knob to give a reading of 20 inches with hose closed off to be sure tester hose does not leak.
- (2) Attach tester vacuum pump hose to tube on distributor vacuum unit. Vacuum gauge should hold on maximum vacuum obtainable if no leak exists.
- (3) Observe contact plate while performing leak test to test response of contact plate. There should be instant response to the pull of the diaphragm, moving the plate without a drag or bind.
- (4) If leakage is indicated, replace vacuum unit assembly.

VACUUM ADVANCE CURVE

Connect tester vacuum pump hose to distributor vacuum advance unit and perform operations 1 through 3 under "**Centrifugal Advance Curve**." Then proceed as follows:

- (1) Turn tester vacuum pump "**On**." Adjust vacuum pump regulator to vacuum test **Specifications**. See "**Specifications**" and observe arrow flashes on tester degree ring to determine degrees of advance.
- (2) If vacuum advance is above or below specifications, replace vacuum advance unit. Retest vacuum advance curve.

IGNITION COIL

The ignition coil is designed to operate with an external ignition resistor 5.9L only. When testing coil for output, include resistor in tests. Inspect for external leaks and arcing.

Test coil according to coil tester Manufacturer's instructions. Test coil primary resistance. Test ignition resistor resistance. Test coil secondary resistance. Replace any coil or ballast resistor that does not meet specifications.

Every time an ignition coil is replaced because of a burned tower, carbon tracking, or any evidence of arcing at tower, nipple or boot on coil end of secondary cable, replace cable. Any arcing at tower will carbonize nipple so that placing it on a new coil will invariably cause another coil failure.

If secondary cable shows any signs of damage, cable should be replaced with a new cable with a hypalon nipple since old cable can cause arcing, and therefore, ruin a new coil.

SPECIFICATIONS

ECU DISTRIBUTOR SPECIFICATIONS		
Listed by Part Number in Numerical Order		
Part Number	4111950	
Rotation	Clockwise	
Firing Order	1-8-4-3-6-5-7-2	
Advance Centrifugal	0.5° to 2.5° @ 650	
(Distributor Degrees at Distributor RPM)	2.5° to 4.5° @ 900	
Advance Vacuum	8.0° to 10.0° @ 2200	
(Distributor Degrees at Inches of Mercury)	1.0° to 2.5° @ 7.0"	
Shaft Side Play*	10.0° to 12.0° @ 15.0"	
Shaft End Play	Not To Exceed .006"	
Air Gap (Start Pick-Up to Reluctor)	.003" to .017"	
Air Gap (Run Pick-Up to Reluctor)**	.006"	
Part Number	4145399	4379070
Rotation	Clockwise	Clockwise
Firing Order	1-8-4-3-6-5-7-2	1-8-4-3-6-5-7-2
Advance Centrifugal	0.5° to 2.5° @ 650	0.5° to 2.5° @ 750
(Distributor Degrees at Distributor RPM)	2.5° to 4.5° @ 900	4.5° to 6.5° @ 1300
Advance Vacuum	8.0° to 10.0° @ 2200	7.5° to 9.5° @ 2200
(Distributor Degrees at Inches of Mercury)	1.0° to 2.5° @ 7.0"	1.0° to 2.5° @ 7.0"
Shaft Side Play*	10.0° to 12.0° @ 15.0"	7.5° to 9.5° @ 15.0"
Shaft End Play	Not To Exceed .006"	Not To Exceed .006"
Air Gap (Start Pick-Up to Reluctor)	.003" to .017"	.003" to .017"
Air Gap (Run Pick-Up to Reluctor)**	.006"	.006"
	.008"	.008"
*Refer to Shaft and Bushing Wear Test **Dual Pick-Up Distributor Only		
ECU—Electronic Control Unit		

SMEC DISTRIBUTOR SPECIFICATIONS		
Listed by Part Number in Numerical Order		
Part Number	4289980	4379230
Rotation	Clockwise	Clockwise
Firing Order	1-8-4-3-6-5-7-2	1-6-5-4-3-2
Shaft Side Play*	Not To Exceed 0.1mm (.004)	Not To Exceed 0.1mm (.004)
Shaft End Play	.08-0.43mm (.003-.017)	.08-0.43mm (.003-.017)
*Refer to Shaft Bushing Wear Test SMEC - Single Module Engine Controller		

SENSOR SPECIFICATIONS					
Component	Number of Terminals	Resistance at F°	Thread Compound	Thread Size	Torque
Coolant Temperature Sensor 3.9L and 5.2L Engines	2	7,000 to 13,000 Ohms About 21°C, 70°F	Preapplied (Nonrequired).	3/8-18 NPTF	28 N-m (20 ft.-lbs.)
		700 to 1,000 Ohms About 93°C, 200°F			
Throttle Body Temperature Sensor 5.2L Engines Only	2	5,600 to 14,600 Ohms About 21°C, 70°F	Silicone Heat Transfer Compound P/N 4300277	M12 × 1.5 (Metric)	11 N-m (100 in.-lbs.)
		400 to 1,500 Ohms About 93°C, 200°F			

IGNITION TIMING AND DISTRIBUTOR APPLICATION

The following specifications are published from the latest information available at the time of publication. If Curb Idle rpm, Ignition or Timing differ from those on the Emission Adjustment and Routing Label, use the specification on the label.

Engine	Fuel System	Transmission	Duty Cycle	Distributor	Spark System	FEDERAL		CALIFORNIA		CANADA	
						Basic* Timing	Idle Set Speed rpm	Basic* Timing	Idle Set Speed rpm	Basic* Timing	Idle Set Speed rpm
3.9L	TBI	M-A	LD	4379230	SMEC	10° BTDC	750	10° BTDC	750	10° BTDC	750
5.2L	TBI	M-A	LD	4289980	SMEC	10° BTDC	700	10° BTDC	700	10° BTDC	700
5.9L	4-BBL	A	LD	4379070***	ECU	12° BTDC*	800			12° BTDC*	800
5.9L	4-BBL	A	LD	4379070***	ECU	12° BTDC Δ	750			12° BTDC Δ	750
5.9L	4-BBL	A & M	HD	4111950	ECU	10° BTDC*	710	10° BTDC*	800	10° BTDC*	800
5.9L	4-BBL	A & M	HD	4145399	ECU	13° BTDC*	800			13° BTDC*	800
5.9L	4-BBL	A	HD	4379070***	ECU	13° BTDC Δ	800				

M—Manual
A—Automatic
BTDC—Before Top Dead Center
★—Basic Ignition Timing $\pm 2^\circ$

*—With Catalyst
**—Without Catalyst
***—Dual Pick-up Distributor
 Δ —High Altitude

LD—Light Duty Cycle
HD—Heavy Duty Cycle
ECU—Electronic Control Unit
SMEC—Single Module Engine Controller

SPARK PLUGS						
Engine	Spark Plug		Gap	Gasket	Torque	Size
	Production Plug	Service Plug				
3.9L and 5.2L	RN12YC	RN12YC	.035" (0.9mm)	Yes	30 Ft. Lbs.	14 mm 3/4" reach
5.9L	RN12YC	RN12YC	.035" (0.9mm)	Yes	30 Ft. Lbs.	14 mm 3/4" reach

IGNITION COIL AND BALLAST RESISTOR			
Coil	Chrysler Prestolite	Chrysler UTC	Diamond
Primary Resistance @ 21°C-27°C (70°-80°F)	1.34 to 1.55	1.34 to 1.55	1.34 to 1.55
Secondary Resistance @ 21°C-27°C (70°-80°F) ..	9,400 to 11,700	9,000 to 12,200	15,000 to 19,000
Ballast Resistor (5.9L only) Resistance @ 70-80 °F.	1.2 ohms		

INSTRUMENT PANEL AND GAUGES

CONTENTS

	Page		Page
CLUSTER AND GAUGE		SWITCH AND PANEL	
SERVICE AND TESTING	4	COMPONENT SERVICE	14
GENERAL INFORMATION	1		

GENERAL INFORMATION

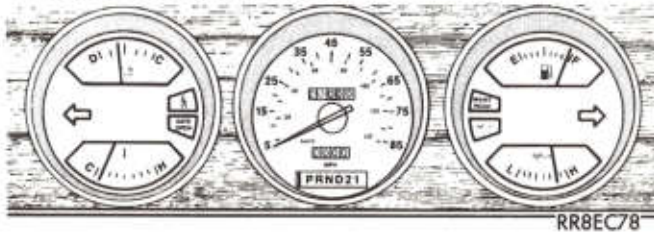


Fig. 1—Instrument Cluster

Instrument Cluster (Fig. 1)

D-body trucks have an instrument cluster which includes gauges for fuel level, coolant temperature, oil pressure, and charging system amperage. The fuel, temperature, and oil pressure gauges operate on an effective 5-volts supplied by the voltage limiter, which is located in the cluster.

The cluster also includes warning lamps for seat belt warning, emissions maintenance required, low oil pressure, and gate open (Ramcharger only).



Fig. 2—Message Center

Message Center (Fig. 2)

The message center, which is located above the heater-A/C controls, includes warning lamps for the brake systems (parking and service) and for the check engine system.

Electronic Digital Clock

The electronic digital clock is in the radio. The clock and radio each use the display panel built into the

radio. A digital readout indicates the time in hours and minutes whenever the ignition switch is in the ON or ACC position.

When the ignition switch is in the OFF position or when the radio frequency is being displayed, time keeping is accurately maintained.

The procedure for setting the clock varies slightly with each radio. The correct procedure is described under the individual radio operating instructions referred to in the Operating Instructions Manual supplied with the vehicle.

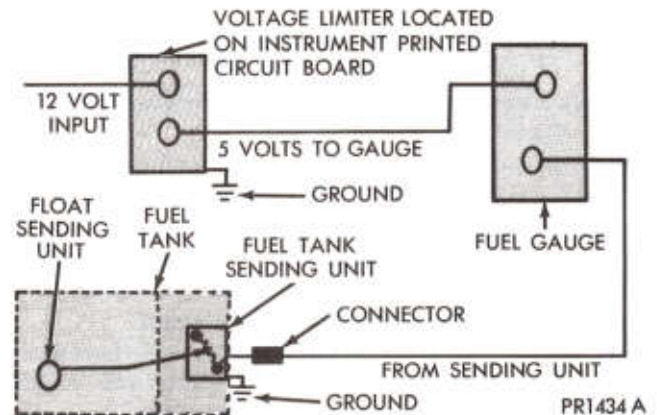


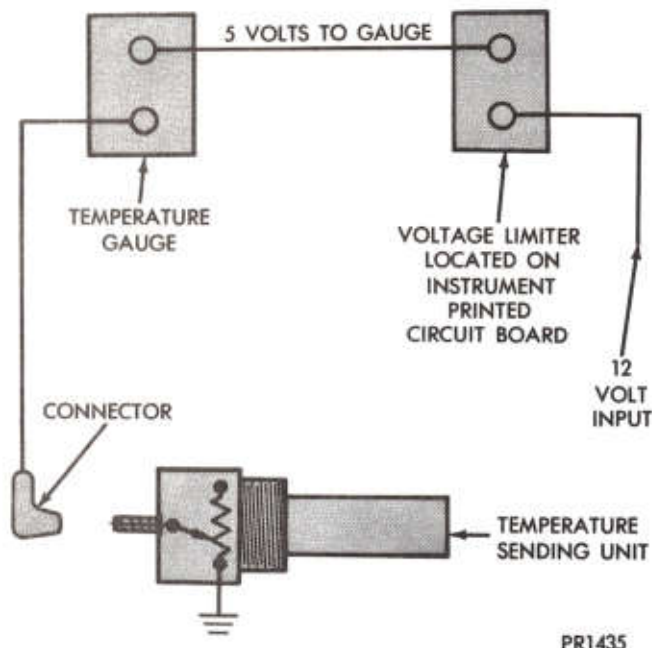
Fig. 3—Fuel Level Indicating System

Fuel Level Indicating System (Fig. 3)

A hinged float arm in the fuel tank raises or lowers dependent on the fuel level. The float arm contacts a variable resistor in the gauge sending unit that provides a change of resistance in the fuel gauge circuit with any up or down movement of the float. This resistance registers on the instrument panel gauge, metered to the capacity of the tank.

When the fuel level in the tank is low, the resistance of the circuit is increased restricting current flow and consequently positions the instrument panel gauge pointer to low.

Resistance in the circuit is at a minimum when the tank is full and the float arm is raised. With resistance at a minimum, current flow is high registering full on the instrument panel gauge.



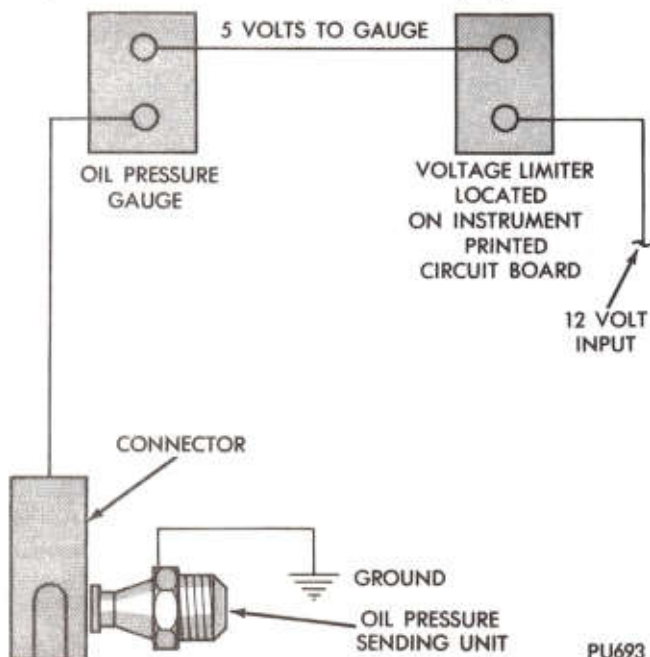
PR1435

Fig. 4—Temperature Indicating System

Temperature and Oil Indicating System (Figs. 4 and 5)

The operation of the temperature and oil pressure indicating systems are identical in operation with the fuel system with the exception of the method of varying the resistance of the sending unit. In the temperature system the sending unit resistance varies in direct relation to the temperature of the coolant.

When the engine is cold the resistance of the disc in the temperature sending unit is high and a low temperature will be indicated on the gauge.



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Fig. 5—Oil Pressure Gauge System

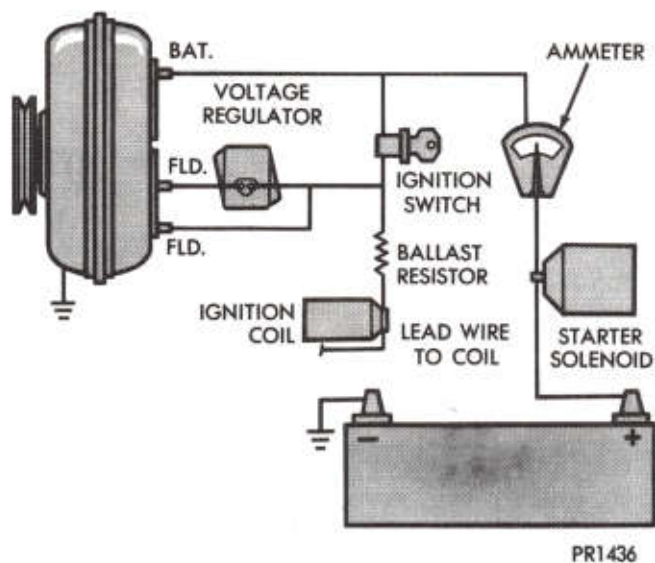
In the oil pressure indicating system the sending unit resistance is actuated by a diaphragm as the oil pressure increases or decreases, which will be indicated on the gauge.

Oil Pressure Warning Lamp

The oil pressure warning switch, mounted on the engine, is controlled by engine oil pressure.

When engine oil pressure is high (normal operating condition of the engine) the switch is held in the OFF or OPEN position allowing no current to flow to the oil pressure warning lamp on instrument panel.

When the engine oil pressure is low the switch is in the ON or CLOSED position allowing current to flow to the oil pressure warning lamp on the instrument panel causing the warning lamp to be illuminated.



PR1436

Fig. 6—Alternator Indicating System

Alternator Indicating System (Fig. 6)

The alternator gauge is an ammeter which senses the direction and rate of flow of electrical current to or from the battery to indicate whether the battery is being charged or discharged.

Speedometer System

The speedometer system consists of the speedometer, a cable from the speedometer to the transmission, and the adapter and pinion in the transmission. Two speedometer cables are used on trucks equipped with speed control; one from the speedometer to the speed control servo unit, and one from the servo unit to the transmission. Refer to the transmission section of the Body and Chassis Manual for disconnecting and attaching the cable at the transmission, selecting the proper pinion, and selecting and indexing the proper adapter.

Careful handling of all components of the speedometer system is necessary to assure smooth, quiet operation of the speedometer. The cables must not be kinked or incorrectly routed, and all fittings must be securely fastened. When installing a new speedometer cable, follow the routing of the cable being removed. Refer to the speedometer and cable diagnosis chart for an aid in isolating the causes of speedometer system malfunctions.

Emissions Maintenance Reminder

This system is designed to act as a reminder that scheduled vehicle emissions maintenance should be performed. It is not intended to indicate a warning or that a state of emergency exists which must be corrected to insure safe vehicle operation. The components covered by the system include the EGR system, PCV valve, oxygen sensor, delay valves, vacuum controlled orifice, fuel tank vapor valve, and bi-level purge valves.

The maintenance required system is based on a time measuring module which uses ignition-on time to calculate maintenance intervals. When predetermined time intervals have elapsed, the "MAINT REQD" lamp in the instrument cluster will illuminate. The lamp will remain lit until the module is reset by inserting a small screwdriver blade or rod into the hole in the module to depress the reset switch which will turn off the lamp.

The maintenance required module is located behind

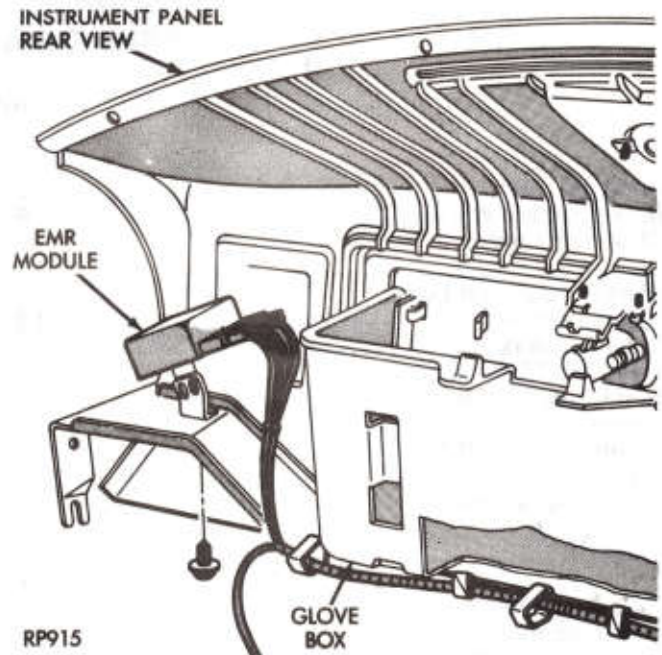


Fig. 7—Emission Maintenance Reminder Module

the far right side of the instrument panel next to the glove box (Fig. 7).

CAUTION: There is no test procedure for this system. Any attempt to test it will result in damage to the system components.

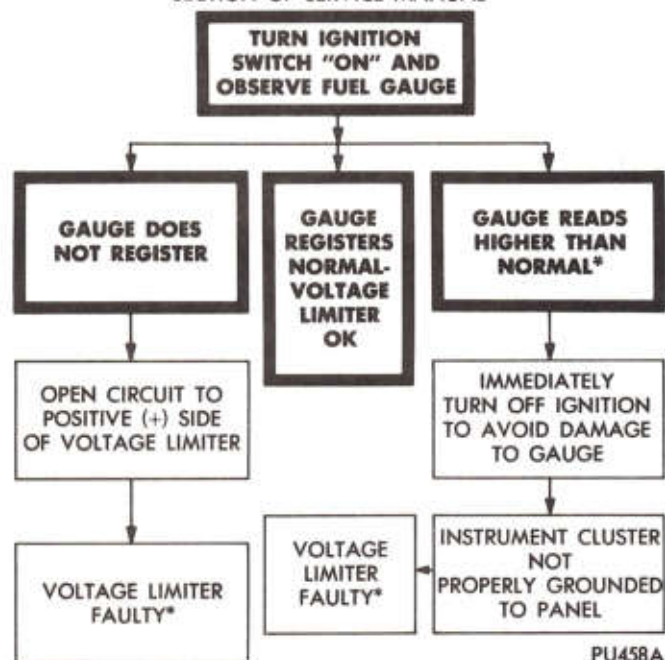
CLUSTER AND GAUGE SERVICE AND TESTING

INDEX

	Page		Page
Ammeter Test	6	Emission Maintenance Reminder	13
Brake System Warning Lamp	9	Gate Open	13
Cluster Assembly	11	High Beam Indicator	13
Cluster Face Plate	11	Low Oil Pressure Indicator	13
Cluster Mask and Lens	11	Seat Belt Warning	13
Component Test Out of Vehicle	13	Turn Signal Indicator	13
Instruments	13	Oil Pressure Gauge Test	7
Printed Circuit Board	13	Oil Pressure Warning Lamp Test	7
Fuel Gauge System Tests		Printed Circuit Board Replacement	13
Results	5	Service Diagnosis	
With Tool 3826A	4	Ammeter	7
Without Tool 3826A	5	Brake System Warning Lamp	9
Gauge Replacement		Fuel Gauge System	6
Ammeter	12	Oil Pressure Gauge	8
Fuel	12	Oil Pressure Warning Lamp	8
Oil	12	Speedometer	10
Speedometer	12	Temperature Gauge	6
Temperature	12	Voltage Limiter	4
Gearshift Indicator (PRND21)	13	Speedometer Cable and Housing	
Lamp Bulb Replacement		Replacement	10
Brake Warning Indicator	13	Temperature Gauge Test	5
Cluster Illumination	13	Voltage Limiter Replacement	13

VOLTAGE LIMITER DIAGNOSIS

*TESTS ARE DESCRIBED IN APPROPRIATE
SECTION OF SERVICE MANUAL



Voltage Limiter—All Models (Fig. 1)

The voltage limiter can be tested in the vehicle or with the instrument cluster removed. To quickly test

the voltage limiter in the vehicle, connect one lead of a voltmeter to the temperature sending unit and the other lead to a good ground. Leave the sending unit lead wire attached to the sending unit.

Turn the ignition switch to the ON position. A fluctuating voltmeter indicates the voltage limiter is operating.

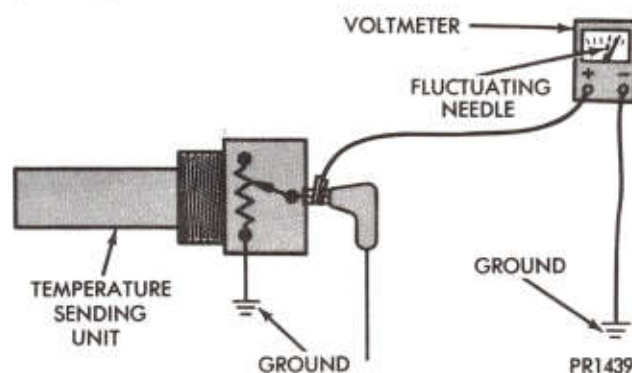


Fig. 1—Voltage Limiter Test

Fuel Gauge System Test

Preparation (Using Tester Tool C-3826A)

(1) Disconnect connector from fuel tank sending unit.

(2) Connect one lead of tester to terminal for dark blue (DB) wire of body side connector and the other lead to a good ground.

Test (Using Tester Tool C-3826A)

(1) Check fuel gauge as described in following steps. Allow at least two minutes at each test point for gauge to settle.

(2) Turn ignition key to ON position, turn tester knob to "E" position and observe gauge. Gauge should read "Empty", plus one pointer width, minus two pointer widths.

(3) Turn tester knob to "1/2", gauge should read "1-2" plus or minus two pointer widths.

(4) Turn tester knob to "F", gauge should read "Full", plus two pointer widths or minus one pointer width.

Preparation (When Tester Tool C-3826A is not available)

(1) Disconnect wire from terminal on fuel tank sending unit.

(2) Connect wire to a **known good** sending unit.

(3) Connect a jumper wire between sending unit fuel pick up tube and a good ground.

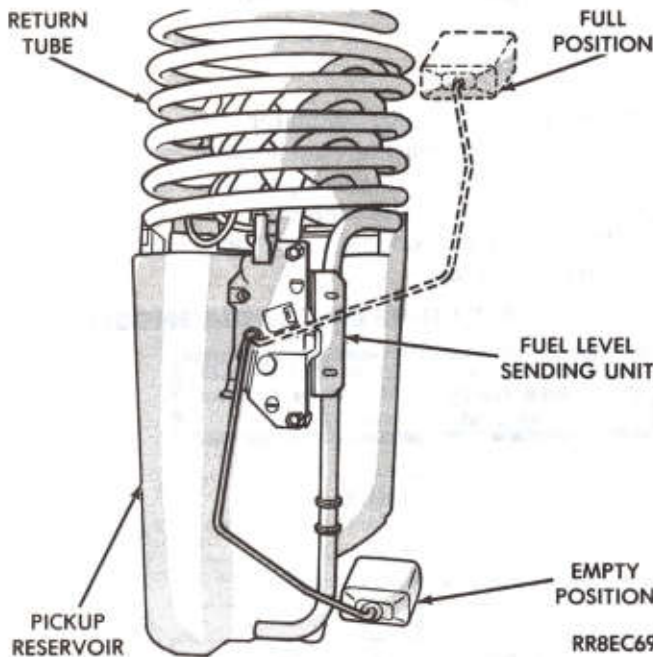


Fig. 2—Fuel Gauge Test without Tester

Test (When Tester Tool C-3826A is not available) (Fig. 2)

(1) Check fuel gauge as described in following steps. Allow at least two minutes at each test point for gauge to settle.

(2) Clip float arm of sending unit to its empty stop and turn ignition key to ON position.

(3) The gauge should read EMPTY, plus one pointer width, or minus two pointer widths.

(4) Move and clip sending units float arm to full

stop. The gauge should read FULL, (plus two pointer widths, or minus one pointer width tolerance).

Results (Both Methods)

(1) If fuel gauge does not meet specifications, check following items as possible causes;

(a) Wiring and connections between the gauge sending unit and multiple connector.

(b) Wiring and connections between multiple connector and printed circuit board terminals.

(c) Circuit continuity between printed circuit board terminals and gauge terminals.

(d) Voltage limiter performance.

If these items check okay, fuel gauge is defective and must be replaced.

(2) If fuel gauge meets specifications with Tool C-3826A or known good sending unit, check fuel tank and original, installed fuel gauge sending unit as follows:

(a) Carefully remove fuel gauge sending unit from tank. Connect sending unit wire and jumper wire as outlined in "Preparation (When Tester Tool C-3826A is not Available)".

(3) If fuel gauge now checks within specifications, original installed sending unit is electrically okay, check following as possible cause:

(a) Ground wire from sending unit to body for continuity,

(b) Sending unit deformed. Make sure sending unit float arm moves freely, and that pick up tube is not bent upwards so that there is not an interference fit with bottom of tank and inspect float.

(c) Sending unit improperly installed. Install properly.

(d) Mounting flange on fuel tank for sending unit deformed. Feel for interference fit of sending unit to bottom of tank. It is permissible to bend pick up tube down a **little** near mounting flange to gain interference fit.

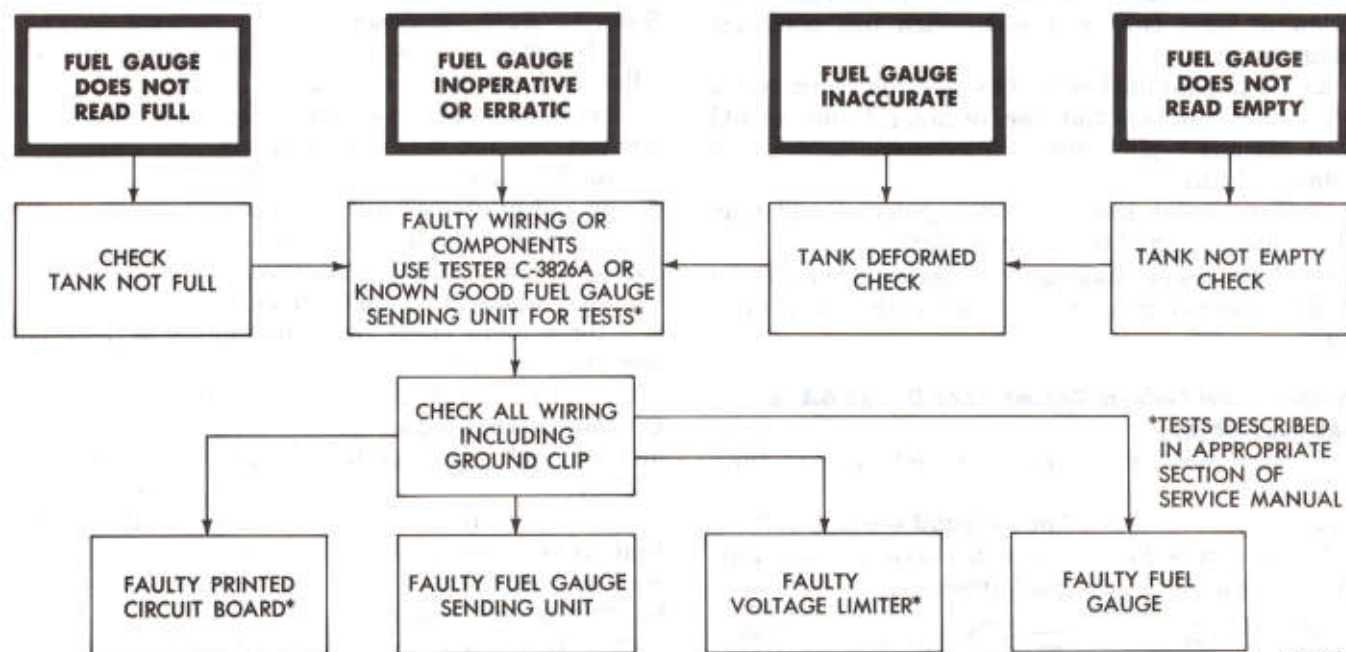
(e) Fuel tank bottom deformed causing improper positioning of sending unit pick up tube. Replace or repair tank and recheck sending unit.

Temperature Gauge Test (Fig. 3)

Disconnect the terminal from the temperature sending unit on the engine. Connect one test lead of tester C-3826A to the terminal and the other test lead to a good ground. Place the pointer of the gauge tester on the "E" position and turn the ignition switch to "on." The temperature gauge should show "C" plus or minus 1/8 inch.

Place the pointer of the tester on the "1/2" position and the temperature gauge should advance to the driving range left of 1/2 position of the dial. Place the pointer of the tester in the "F" position and the gauge should advance to the "H" position of the dial. Should

FUEL GAUGE SYSTEM DIAGNOSIS



PR1442B

the gauge respond to the above tests but not operate when the terminal is attached to the sending unit, indications are of a defective sending unit and it should be replaced.

Should the gauge fail to respond to the above tests, indications are of possible loose connections, broken wire, open printed circuit, or faulty gauge. The instrument cluster should be removed for further inspection. See "Instrument Cluster Removal."

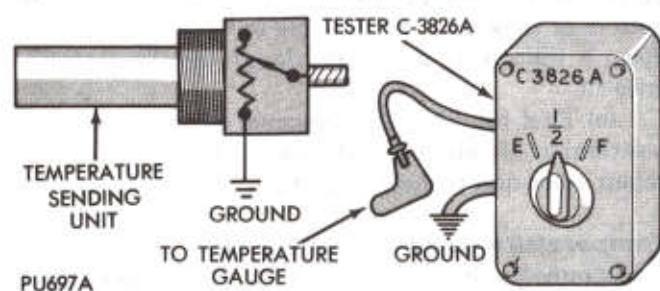


Fig. 3—Temperature Gauge Test

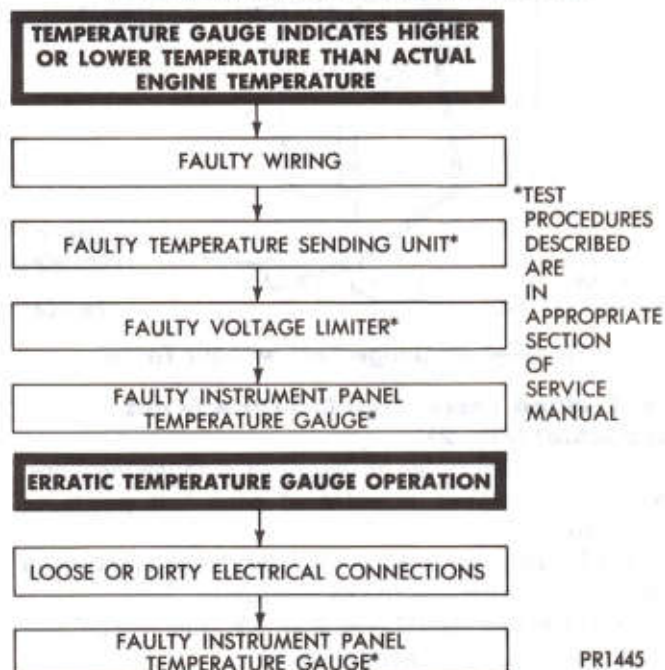
Ammeter Test

Turn ignition ON (do not start engine). Turn headlamps on. The ammeter needle should move toward the "D" or discharge scale. If no movement of the needle is observed, check the terminals for loose wires. If the terminals are secure, the ammeter is defective. If the needle moves toward "C" or charge the connections are reversed.

With the shunt type ammeter, the main vehicle current is in a separate lead located in the engine compartment wiring. A small portion of the current is tapped off to supply the ammeter.

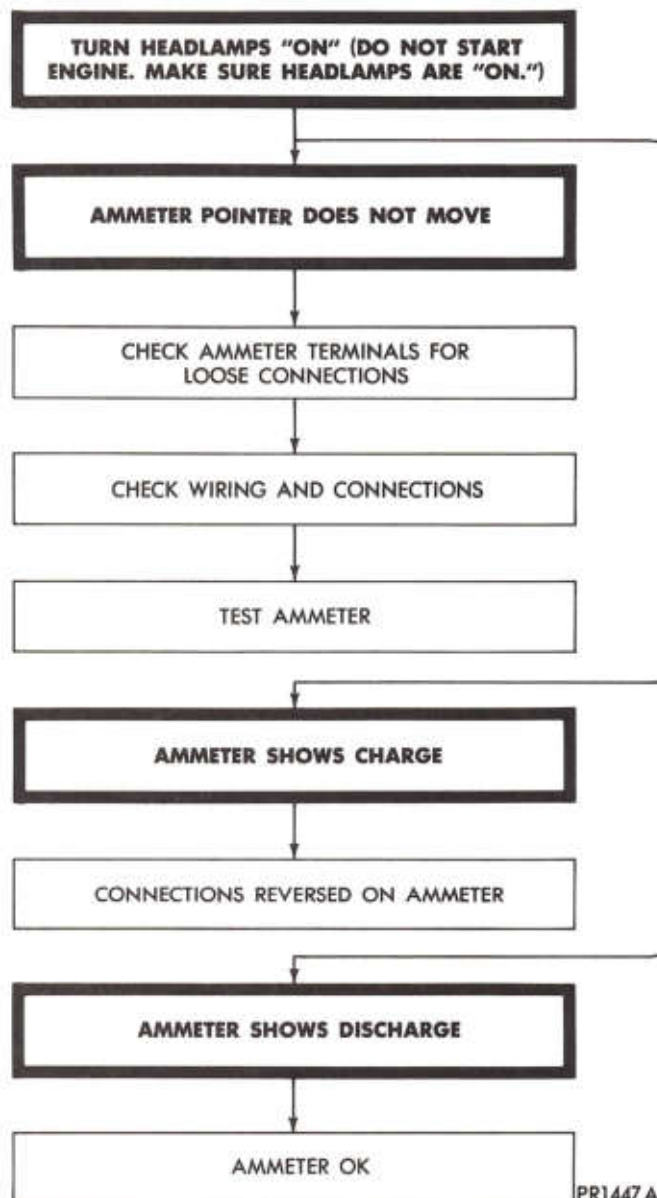
CAUTION: Do not connect any accessories to the ammeter terminals.

TEMPERATURE GAUGE DIAGNOSIS



PR1445

AMMETER DIAGNOSIS



Oil Pressure Gauge Test—(If so equipped Fig. 4)

Disconnect wire from the oil pressure sending unit on the engine. Connect one test lead of Tester Tool C-3826-A to the terminal for the gray wire with yellow tracer (GY/YL) and the other test lead to a good ground. Place the pointer of the gauge tester on the "E" position and turn the ignition switch to ON. Do not start engine. The oil pressure gauge should show "L" plus or minus 1/8 inch.

Place the pointer on the tester on the "1/2" position and the oil pressure gauge should advance to the 1/2

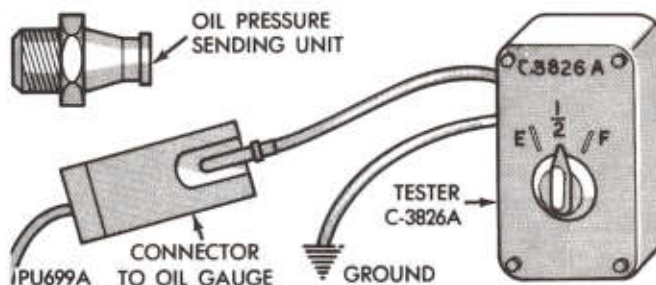


Fig. 4—Oil Pressure Gauge Test

position of the dial. Place the pointer of the tester in the "F" position and the gauge should advance to the "H" position of the dial.

Should the gauge respond to the above tests, but not operate when the wire is attached to the sending unit, the sending unit is defective. Should the gauge fail to respond to the above tests indications are of possible loose connections, broken wire, or faulty gauge. The instrument cluster should be removed for further tests. See "Instrument Cluster."

Oil Pressure Warning Lamp Test

To check the low oil pressure warning lamp system, turn ignition key to ON position and observe if oil pressure light comes on. If light comes on proceed and start engine. **If the lamp remains on immediately turn engine off and check engine oil pressure according to procedures as outlined in the engine section of this manual.** If it is determined that oil pressure is according to specifications, check for a grounded wire and/or replace oil pressure sending unit. When turning ignition key to the ON position and the oil pressure lamp does not come on, disconnect lead at sending unit and touch female terminal for gray (GY) wire to ground. If the lamp bulb comes on replace the sending unit. If the lamp bulb does not come on the lamp bulb is burned out or the bulb socket, wiring and connections are faulty.

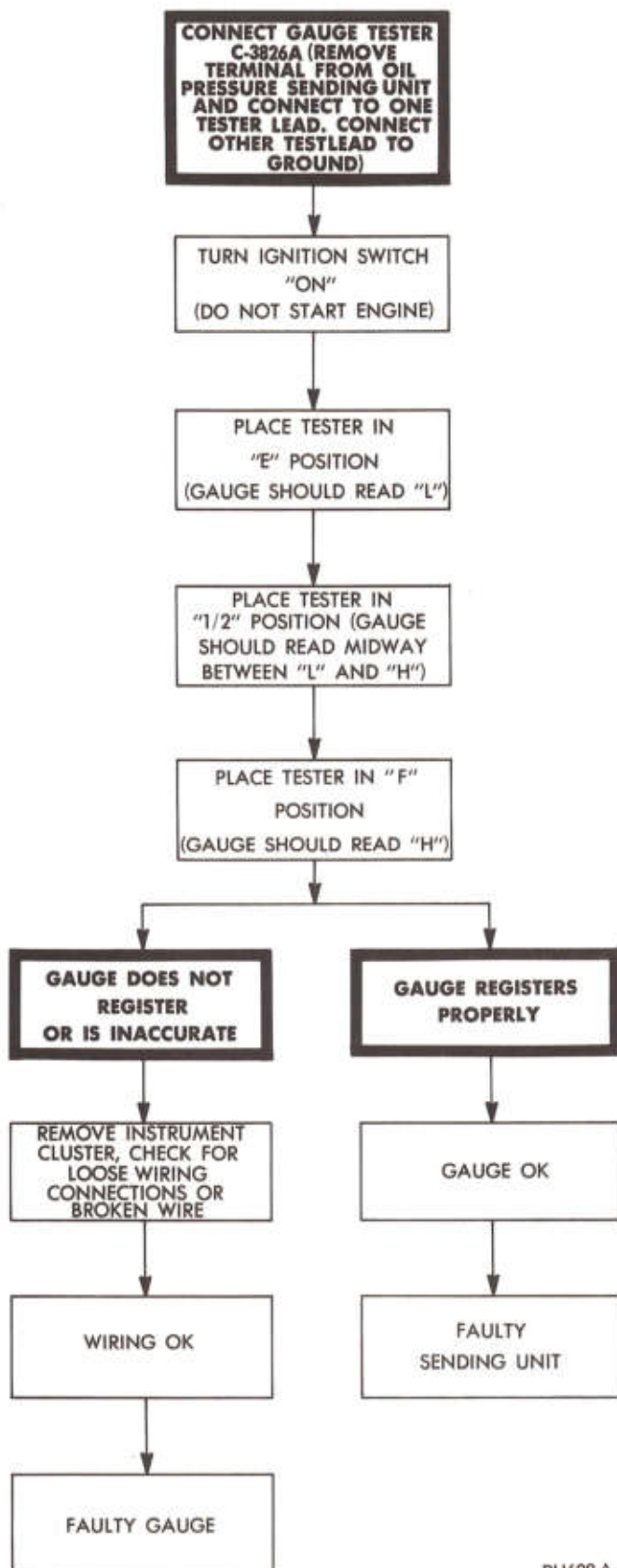
Three-Terminal Oil Pressure Switch Test (Carbureted Engines) (Fig. 5)

The three-terminal oil pressure switch has two functions:

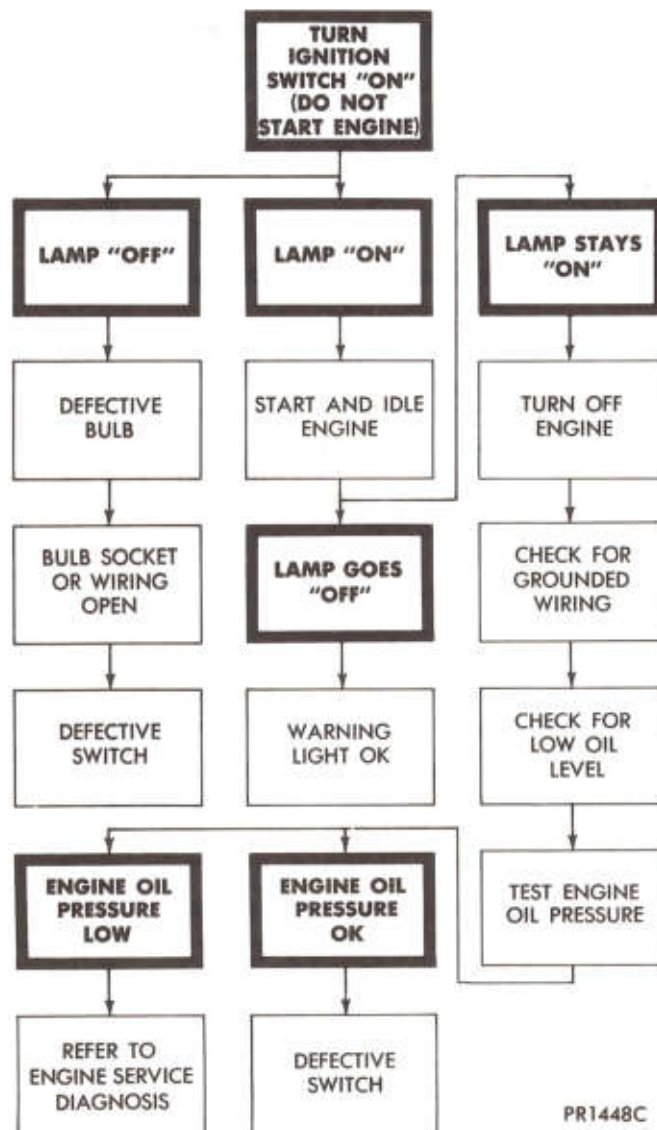
- (1) The normally closed circuit keeps the oil pressure warning light on until there is oil pressure.
- (2) The normally open circuit does not allow the choke heater to operate until there is oil pressure.

To test the normally closed oil light circuit, pull off the molded electrical connector and measure the resistance between the center blade and the case. The ohmmeter should read zero ohms. Start the vehicle. If there is oil pressure, the ohmmeter should read an open circuit.

OIL PRESSURE GAUGE WARNING SYSTEM DIAGNOSIS



ENGINE WARNING LAMP DIAGNOSIS OIL PRESSURE FUNCTION



PR1448C

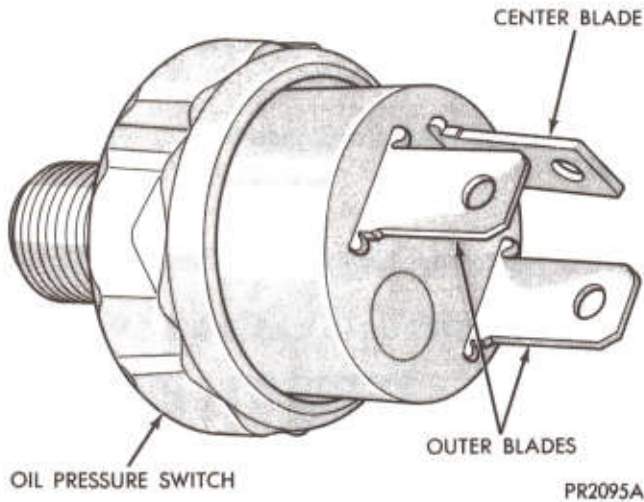


Fig. 5—Oil Pressure Lamp Switch Terminals (Carbureted Engines)

To test the normally open circuit, place the ohmmeter between the two outer blades; the meter should read open. Start the vehicle; the ohmmeter should read zero ohms.

Brake System Warning Lamp (Fig. 6)

The brake warning lamp lights only when the parking brake is applied with the ignition key turned ON. The same lamp will also illuminate should one of the two service brake systems fail when the brake pedal is applied. To test the system turn the ignition key ON, and apply the parking brake. If the lamp fails to light, inspect for a burned out bulb, disconnected socket, a broken or disconnected wire at the switch. The lamp also lights when the ignition switch is turned to the START position.

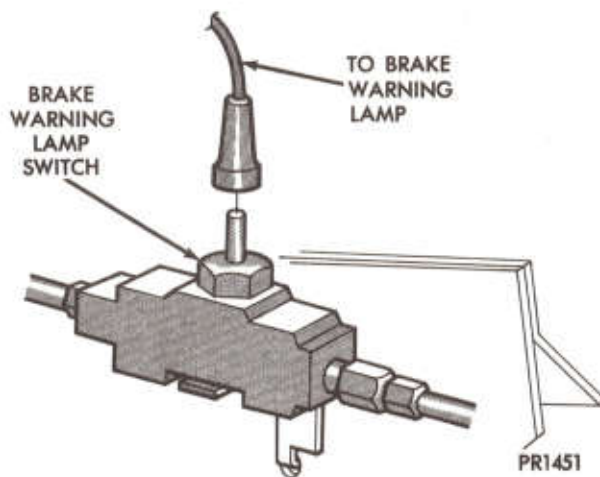
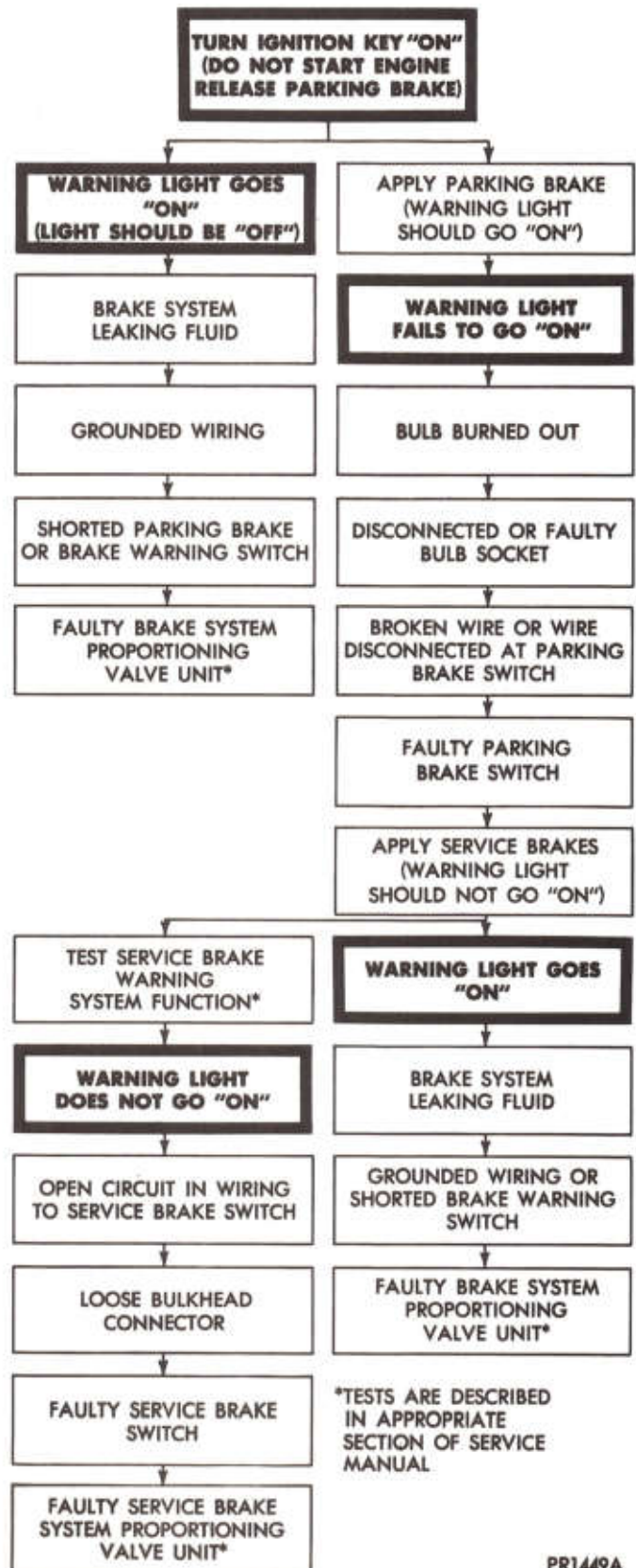


Fig. 6—Brake Warning Lamp Switch

BRAKE SYSTEM WARNING LAMP DIAGNOSIS



To test the service brake warning system, raise the vehicle on a hoist and open a wheel cylinder bleeder while a helper depresses the brake pedal and observes the warning light. If the lamp fails to light, inspect for a burned out bulb, disconnected socket, a broken or disconnected wire at the switch. If the bulb is not burned out and the wire continuity is proven, replace the brake warning switch in the brake line "Tee" fitting mounted on the frame rail in the engine compartment below the master cylinder.

Speedometer System

The speedometer system consists of the speedometer, a cable from the speedometer to the transmission, and the adapter and pinion in the transmission. Two speedometer cables are used on vehicles equipped with speed control; one from the speedometer to the speed control servo unit, and one from the servo unit to the transmission. Refer to the transmission section of the Body and Chassis Manual for disconnecting and attaching the cable at the transmission, selecting the proper pinion, and selecting and indexing the proper adapter.

Careful handling of all components of the speedometer system is necessary to assure smooth, quiet operation of the speedometer. The cables must not be kinked or incorrectly routed, and all fittings must be securely fastened. When installing a new speedometer cable, follow the routing of the cable being removed. Refer to the speedometer and cable diagnosis chart for an aid in isolating the causes of speedometer system malfunctions.

Cable Connection at Speedometer (Fig. 7)

The speedometer cable is connected to the speedometer with a snap-on ferrule. This type ferrule attaches directly to the speedometer head and must be disconnected before the speedometer or cluster can be re-

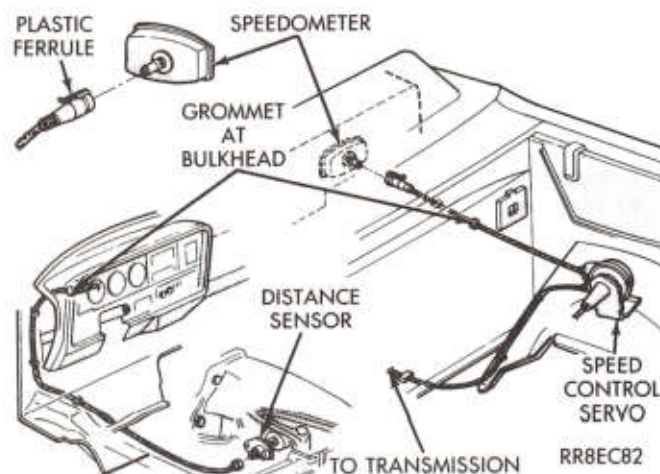


Fig. 7—Speedometer Cable Routing and Connections

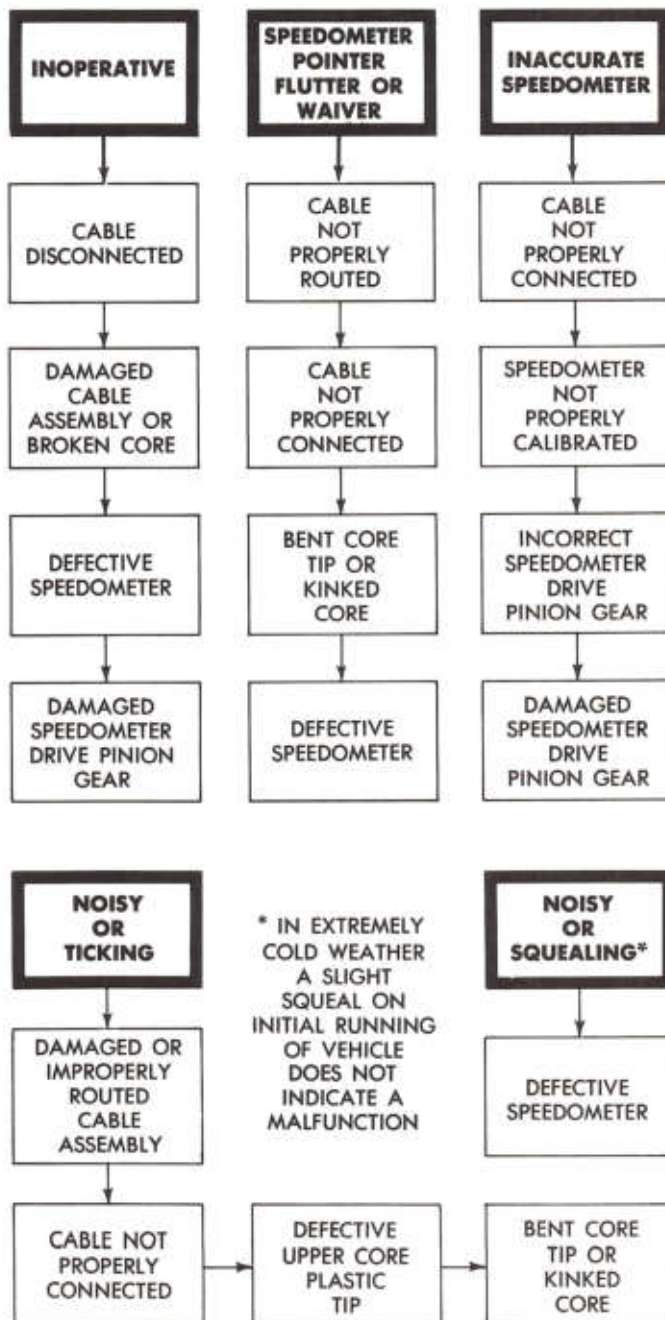
moved. On vehicles equipped with speed control, to provide additional working length at the speedometer, first disconnect the cable from the speed control servo.

Speedometer Cable and Housing Replacement (Fig. 7)

Removal

- (1) Disconnect fusible link located under hood.

SPEEDOMETER AND CABLE DIAGNOSIS



PR1453A

(2) Disconnect speedometer cable from transmission, distance sensor, lower cable or speed control servo.

(3) Remove instrument cluster face plate.

(4) Remove trip odometer knob.

(5) Remove (8) screws fastening lens to instrument panel cluster assembly and remove lens and mask.

(6) Remove speedometer assembly mounting screws from cluster assembly.

(7) Depress tab on plastic speedometer ferrule and disconnect speedometer from speedo cable.

(8) Push upper ferrule end of speedometer cable and grommet through dash panel into engine compartment.

Installation

(1) Route speedometer cable. **Routing must be free of sharp bends and kinks.**

(2) Connect cable to transmission, distance sensor, lower cable, or speed control servo.

Tighten speedometer cable to 35 ± 5 in. lbs. Over-tightening cable connections may cause improper cable operation.

(3) Position upper cable and grommet.

(4) Connect speedo cable to speedometer

(5) Install speedometer into cluster.

(6) Install mask and lens.

(7) Install trip odometer knob.

(8) Install instrument cluster faceplate.

(9) Connect fusible link and check operation of speedometer.

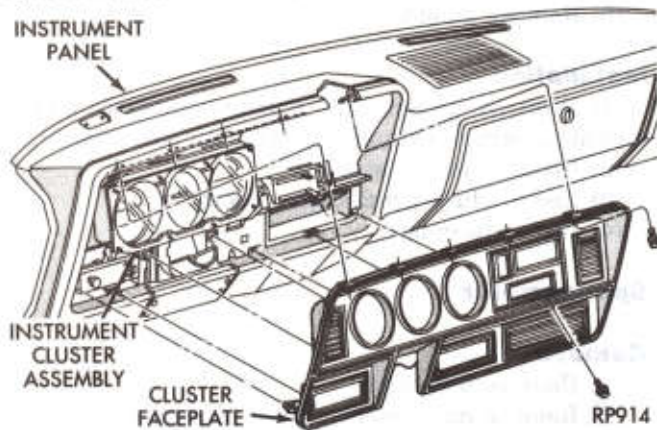


Fig. 8—Instrument Cluster Faceplate

CLUSTER FACEPLATE (Fig. 8)

Removal

(1) Remove two (2) screws and remove map lamp.

(2) Remove six (6) screws which attach faceplate to base panel. Make sure the screw below the Heater-A/C control is removed.

(3) Place column shift lever in Position '1'.

(4) Remove faceplate by pulling top edge rearward to clear brow, disengage attaching clips around bottom of faceplate, complete removal of faceplate.

(5) If faceplate is four wheel drive indicator equipped, disconnect wires as faceplate is removed.

(6) Disconnect message center wires.

Installation

(1) Connect wires for four wheel drive indicator if so equipped.

(2) Connect message center wires.

(3) Engage attaching clips around bottom of faceplate, roll faceplate into position.

(4) Install six (6) mounting screws.

(5) Install map lamp.

CLUSTER MASK AND LENS

Removal

(1) Remove faceplate.

(2) Remove eight (8) screws.

(3) Unscrew odometer reset knob.

(4) Remove mask and lens.

Installation

(1) Position mask and lens.

(2) Install odometer reset knob.

(3) Install eight (8) screws.

(4) Install faceplate.

CLUSTER ASSEMBLY (Fig. 9)

Removal

(1) Tape or cover steering column to prevent damage to paint.

(2) Remove faceplate.

(3) Remove lower steering column cover four (4) screws.

(4) Spread upper steering column cover out of the locking tangs and slide downward.

(5) Disconnect "PRND21" actuator cable from steering column.

(6) Loosen heater and A/C control. Pull rearward to clear forward mount on cluster housing.

(7) Remove six (6) screws that retain cluster. Pull cluster rearward and:

(a) Disconnect two (2) large connectors and one (1) small connector near speedometer cable.

(b) Disconnect speedometer cable.

(c) Remove EMR and/or gate open lamp sockets.

(8) Remove cluster.

Installation

(1) Connect EMR and/or gate open lamp sockets to cluster.

(2) Connect speedometer cable to cluster.

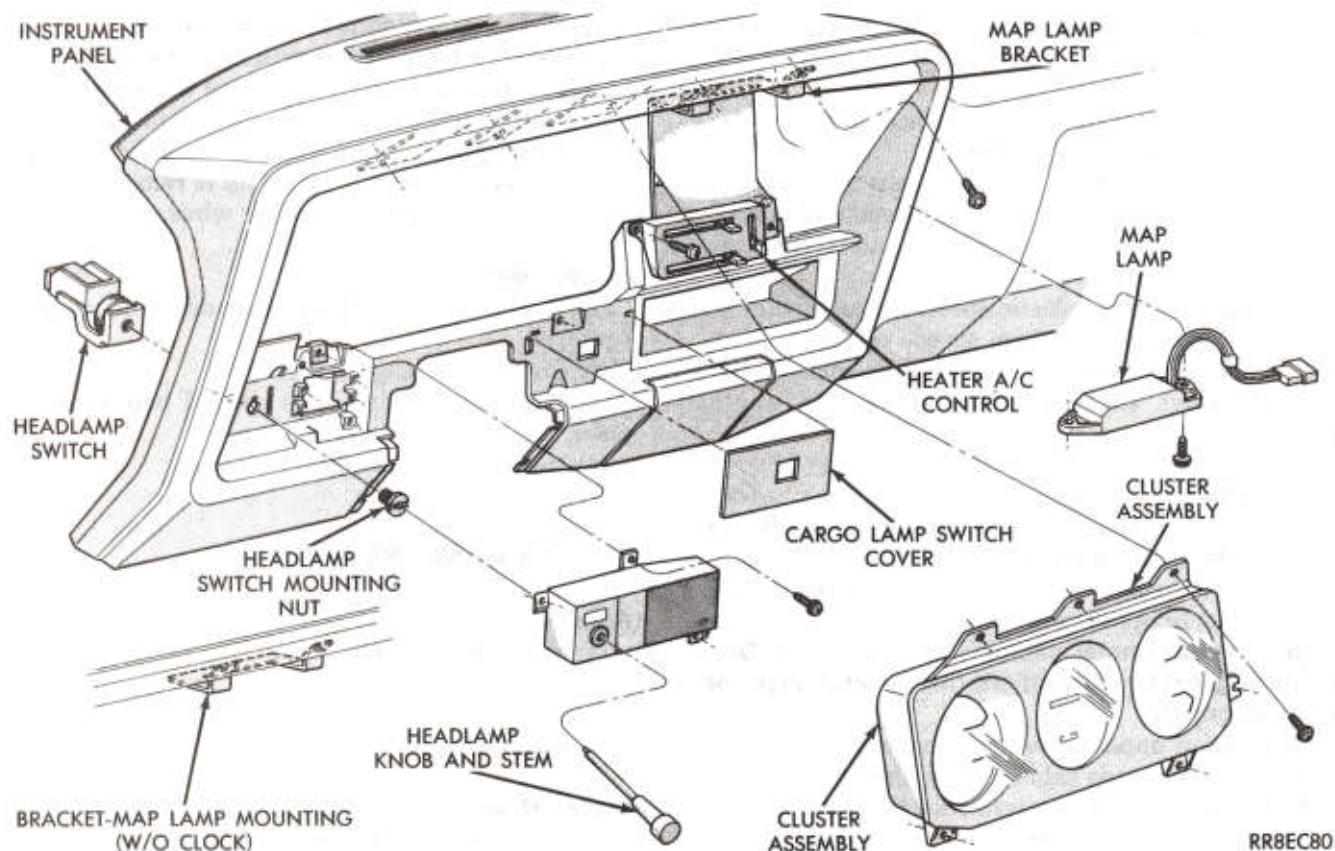


Fig. 9—Instrument Panel Cluster and Switches

- (3) Connect two (2) large connectors and one (1) small connector to cluster.
- (4) Position cluster to instrument panel and install six (6) retaining screws.
- (5) Install heater A/C control.
- (6) Connect "PRND21" actuator to steering column.
- (7) Position upper steering column cover and slide upward until tangs snap into place.
- (8) Position lower steering cover and install four (4) screws.
- (9) Install faceplate.
- (10) Remove protective cover from steering column.
- (11) Check to see that all instruments are functioning properly.

GAUGE REPLACEMENT

Fuel Gauge
Temperature Gauge
Ammeter Gauge
Oil Gauge

Removal

- (1) Remove faceplate, cluster mask-lens.
- (2) Remove cluster assembly. (See cluster assembly removal).
- (3) Locate terminals of gauges on circuit board side of cluster.

- (4) Remove gauge attaching nuts (2 per gauge).
- (5) Remove gauge.

Installation

- (1) Position gauge into cluster housing, install mounting screws or nuts, and tighten securely.
- (2) Install cluster assembly.
- (3) Install cluster mask-lens assembly.
- (4) Install faceplate.

Speedometer

Removal

- (1) Remove faceplate.
- (2) Remove instrument cluster assembly.
- (3) Remove cluster mask-lens.
- (4) Remove mounting screws retaining speedometer to housing.
- (5) Remove speedometer.

Installation

- (1) Position speedometer in cluster housing and install mounting screws.
- (2) Install cluster mask-lens.
- (3) Install instrument cluster assembly.
- (4) Install faceplate.

PRINTED CIRCUIT BOARD

Removal

- (1) Remove cluster mask-lens.
- (2) Remove cluster assembly. (See cluster assembly removal).
- (3) Remove fuel, temperature, oil, and ammeter gauges. It is not necessary to remove speedometer.
- (4) Remove voltage limiter and radio noise suppression capacitors.
- (5) Remove all lamp socket assemblies by rotating counterclockwise.
- (6) Remove mounting screws attaching printed circuit board to cluster housing.
- (7) Remove printed circuit board.

Installation

- (1) Position printed circuit board on cluster housing, install mounting screws, and tighten snugly.

CAUTION: Do not over tighten mounting screw for damage to printed circuit board will occur.

- (2) Install all lamp socket assemblies to printed circuit board and lock into place by rotating clockwise.
- (3) Install voltage limiter and radio noise suppression capacitors.
- (4) Install fuel, temperature, oil, and ammeter gauges.
- (5) Install cluster assembly.
- (6) Install cluster mask-lens.
- (7) Install faceplate.

VOLTAGE LIMITER

Removal and Installation

Reach up behind instrument cluster and pull out or plug in voltage limiter. The voltage limiter is located to the left of the speedometer cable.

CLUSTER COMPONENTS TESTS OUT OF VEHICLE

Printed Circuit Board

A visual inspection of the conductors should be made for cracks or damaged circuits. If no visual damage is evident, each circuit should be tested for continuity with an ohmmeter or a test light. Should an open circuit be detected, the printed circuit board should be replaced.

Instruments

- (1) Connect a jumper wire to voltage limiter input (ign.) terminal. Connect other end of the jumper wire to positive post (+) of a 12 volt test battery.
- (2) Connect a jumper wire from negative (-) post of battery to instrument cluster base (ground).

- (3) Connect one lead from Tester C-3826A to gauge sending terminal being tested.

- (4) Connect remaining tester lead to instrument cluster base (ground).

When the gauge tester is in "E" position, the gauge being tested should read on the low side of the dial. With gauge tester on "1/2", the gauge should read in the center of the dial scale and on the high end of the dial when pointer of tester is placed on "F". If gauges do not perform as stated, inspect for an open printed circuit before replacing gauge.

CAUTION: A direct connection from a 12 volt battery will damage the gauges or printed circuit boards.

PRND21 INDICATOR

Removal

- (1) Remove faceplate.
- (2) Remove mask-lens.
- (3) Remove cluster assembly (see cluster assembly removal).
- (4) Remove screws attaching PRND21 mechanism to cluster housing.
- (5) Remove PRND21 mechanism.

Installation

- (1) Position PRND21 mechanism to cluster housing.
- (2) Install mounting screws.
- (3) Install cluster assembly.
- (4) Install mask-lens.
- (5) Install faceplate.

LAMP BULBS

Heater Only Equipped Vehicles
Cluster Illumination Lamps
Brake Warning Indicator Lamp
Turn Signal Indicator Lamps
Low Oil Pressure Indicator Lamp
High Beam Indicator Lamp
EMR Lamp
Gate Open Lamp
Seat Belt Warning Lamp

Removal

- (1) Reach up behind instrument panel and remove socket assembly from printed circuit board by turning counterclockwise.
- (2) Remove bulb from socket.

Installation

- (1) Install bulb into socket.
- (2) Position socket assembly into opening in printed circuit board making sure locking tabs on socket are properly indexed in opening.
- (3) Turn assembly clockwise to lock into place.

Air Conditioned Equipped Only
Right and Left Outer Illumination Lamps
High Beam Indicator
Left Turn Signal Indicator
Seat Belt Warning Lamp

Removal

- (1) Remove cluster assembly.

- (2) Remove lamp bulb and socket.

Installation

- (1) Install bulb and socket.
- (2) Install cluster assembly.

SWITCH AND PANEL COMPONENT SERVICE

INDEX

	Page		Page
Ash Tray	19	Headlamp Switch	21
Housing	20	Heater or A/C Control Illumination	21
Tray	19	Map Lamp	21
Cigar Lighter	19	Snow Plow Controls	21
Emission Maintenance Reminder Module	18	Message Center Module	18
Fuse Block	18	Steering Column Lowering and Raising	14
Four Wheel Drive Indicator	19	Lowering Steering Column	14
Glove Box	20	Raising Steering Column	14
Catch	21	Switches	15
Door and Bin	20	Auxiliary Headlamp	16
Lock	20	Cargo Lamp	17
Heater Controls	14	Glove Box	17
Heater and Air Conditioning Controls	15	Headlamp	15
Hood Release	18	Map Lamp	17
Illumination Bulbs Replacement	21	Overdrive Lockout	17
Ash Tray Illumination	21	Snow Plow Toggle	16
Four Wheel Drive Indicator	21		

DISCONNECT NEGATIVE BATTERY CABLE IN ENGINE COMPARTMENT BEFORE SERVICING INSTRUMENT PANEL.

STEERING COLUMN LOWERING AND RAISING (Fig. 1)

When servicing the instrument panel and the **Lowering** and **Raising** of the steering column is required, the following is the procedure for doing so:

This procedure is not for removing and replacing the steering column. Refer to Group (19) of this manual for the removal and replacement procedures.

Lowering Steering Column

- (1) Remove three toe plate nuts and washers.
- (2) Remove one toe plate screw.
- (3) Remove four (4) screws attaching lower steering column cover and remove cover.
- (4) Spread upper steering column cover out of locking tangs and slide downward.
- (5) Disconnect cable from shift indicator bracket.
- (6) Remove two nuts and washers attaching steering column bracket to instrument panel steering column support bracket.
- (7) Allow column to lower and rest on seat.

Raising Steering Column

- (1) Raise steering column assembly against the instrument panel support bracket.

- (2) Install two steering column bracket washers and nuts (Finger Tighten Only).

CAUTION: Check that all wiring is clear and not pinched.

- (3) Tighten the two bracket nuts to 110 inch-pounds (12 N·m) torque.

- (4) Slide toe plate into position, install attaching screw, tighten to 35 in. lbs. (4 N·m).

- (5) Install toe plate nuts and washers and tighten to 200 in. lbs. (23 N·m).

- (6) Connect cable to shift indicator bracket (Fig. 2).

- (7) Position upper steering column cover and slide upward until tangs snap into place.

- (8) Position lower steering column cover and install four attaching screws.

HEATER CONTROL

Removal

- (1) Remove faceplate.
- (2) Remove two (2) control attaching screws.
- (3) Pull control rearward.
- (4) Disconnect illumination lamp.
- (5) Disconnect control cables.
- (6) Remove control.

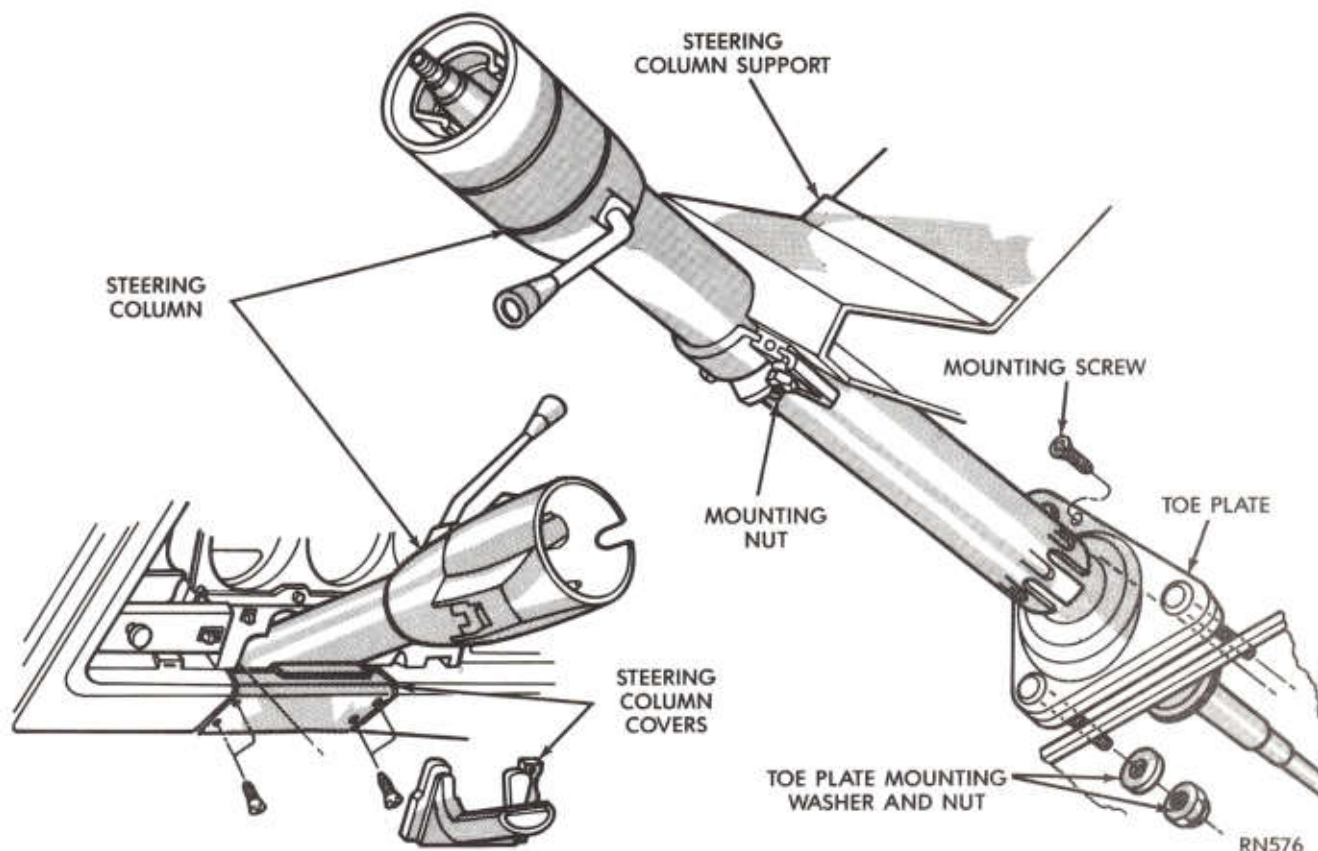


Fig. 1—Steering Column Mounting

Installation

- (1) Position control near panel.
- (2) Connect control cables to control (see Heater A/C Section).
- (3) Connect illumination lamp.
- (4) Push control into panel.
- (5) Install two (2) control mounting screws.
- (6) Install faceplate.

- (3) Connect vacuum harness.
- (4) Connect illumination lamp.
- (5) Attach three (3) wire connectors to pushbutton switch.
- (6) Connect wires to blower motor switch.
- (7) Push control into panel.
- (8) Install two (2) control mounting screws.
- (9) Install cluster faceplate.

HEATER A/C CONTROL

Removal

- (1) Remove faceplate.
- (2) Remove two (2) control attaching screws.
- (3) Pull control rearward.
- (4) Disconnect blower switch wiring.
- (5) Disconnect wires to pushbutton switch (three (3) connectors).
- (6) Disconnect illumination lamp.
- (7) Disconnect vacuum harness.
- (8) Disconnect temperature cable.
- (9) Remove control.

Installation

- (1) Position control near panel.
- (2) Connect temperature cable (see Heater A/C Section).

SWITCHES

Headlamp Switch (Fig. 2)

Removal

- (1) Remove cluster faceplate.
- (2) Reaching under instrument panel, depress knob and stem release button located on bottom of switch housing and at same time pull knob and stem assembly out of switch housing located on front of panel.
- (3) Remove wiper switch knob.
- (4) Remove bezel.
- (5) From front of panel remove spanner nut, mounting switch to panel.
- (6) Reaching under instrument panel, lower switch down far enough to disconnect electrical leads.
- (7) Remove switch.

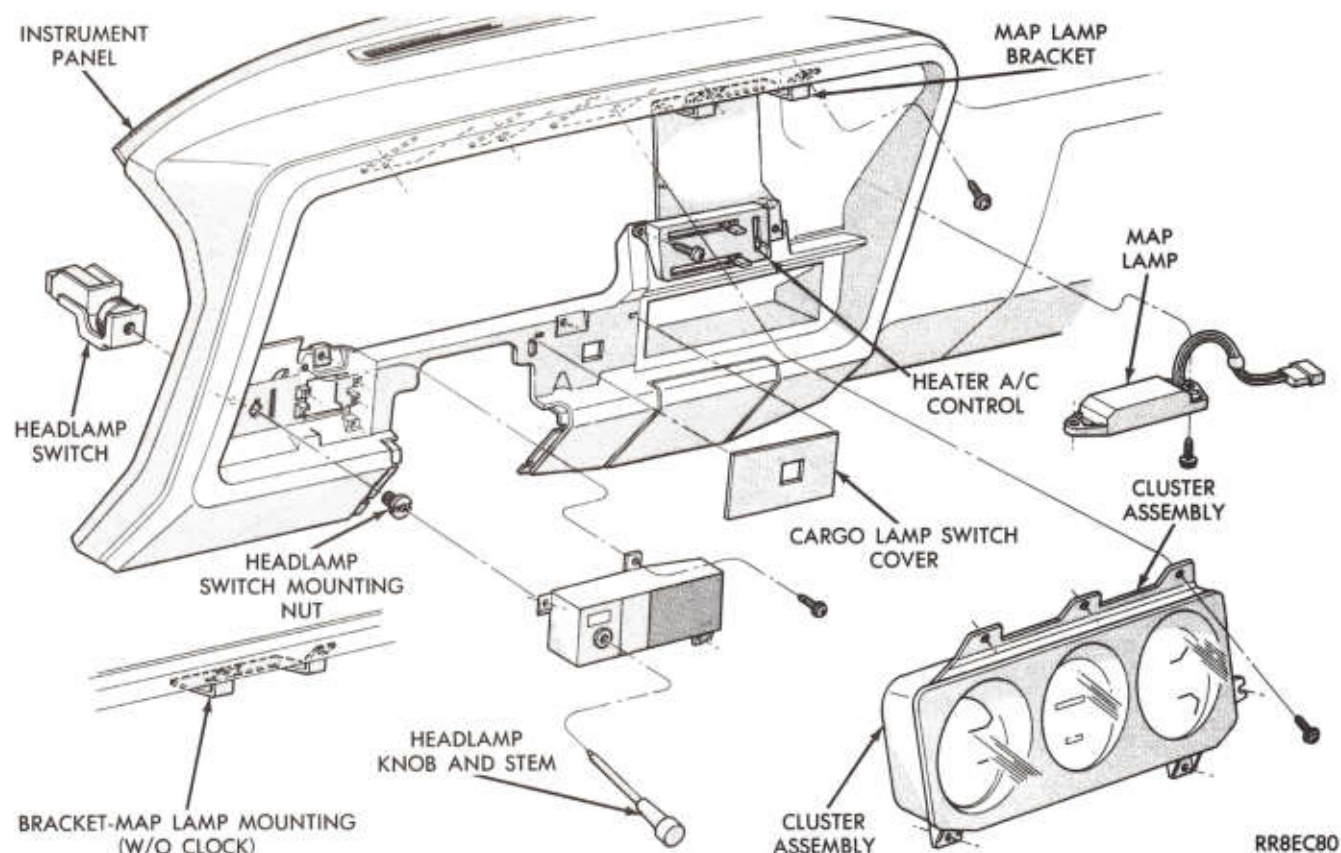


Fig. 2—Instrument Panel Switches

Installation

- (1) Connect all electrical leads to switch.
- (2) Guide switch into position in panel, install spanner nut and tighten securely.
- (3) Install bezel.
- (4) Install wiper switch knob.
- (5) Insert knob and stem assembly into switch.
- (6) If so equipped, install air conditioner duct, and air outlet assembly.
- (7) Install cluster faceplate.
- (8) Check operation of switch.

Auxiliary Headlamp Switch (Fig. 3)
(Used with Snow Plow Option)
Removal

- (1) Remove two (2) screws on right side of snow plow control housing.
- (2) Loosen two (2) screws on left side of housing and slide housing to the right and pull away from instrument panel.
- (3) Remove four (4) screws holding bezel to housing.
- (4) Pull rearward, disconnect wire from headlamp switch.
- (5) Remove auxiliary headlamp switch by snapping out of bezel.

Installation

- (1) Snap auxiliary headlamp switch into bezel.
- (2) Connect wires to switch.
- (3) Position bezel to housing and install four mounting screws.
- (4) Check operation of switch.
- (5) Position housing onto left side screws (2), install right side screws (2) and secure housing to instrument panel.

Snow Plow Toggle Switch (Fig. 3)**Removal**

- (1) Remove two (2) screws on right side of snow plow control housing.
- (2) Loosen two (2) screws on left side of housing and slide housing to the right and pull away from instrument panel.
- (3) Remove four (4) screws holding bezel to housing.
- (4) Pull rearward, disconnect wire from toggle switch.
- (5) Remove toggle switch by unscrewing nut from front of bezel.

Installation

- (1) Position toggle switch to bezel and install nut.
- (2) Connect wires to toggle switch.

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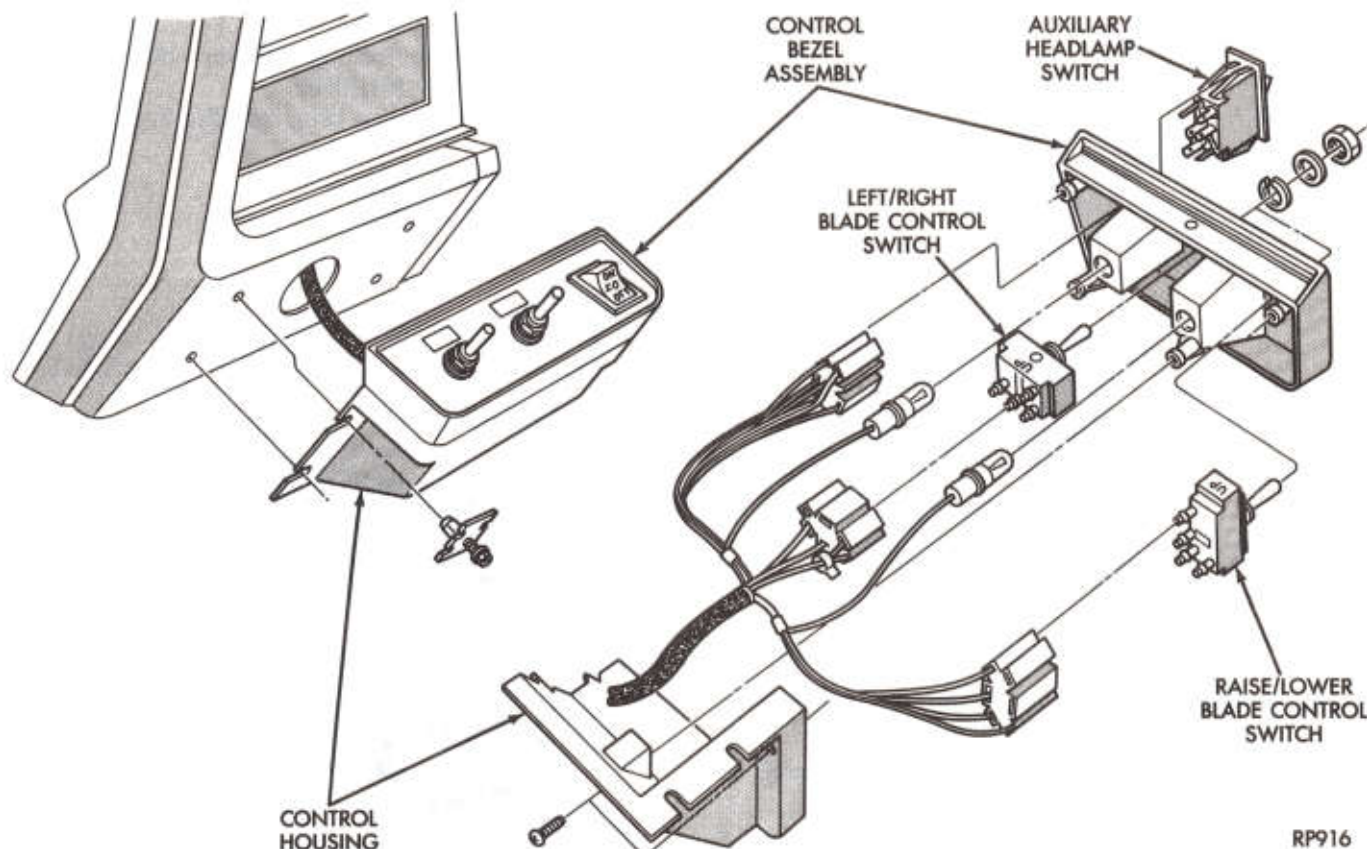


Fig. 3—Snow Plow Control Assembly

- (3) Position bezel to housing and install four (4) mounting screws.
- (4) Check operation of switch.
- (5) Position housing onto left side screws (2), install right side screws (2) and secure housing to instrument panel.

Cargo Lamp Switch

Removal

- (1) Locate and remove wiring connector under the instrument panel.
- (2) Depress lock tabs, on switch and remove from instrument panel.

Installation

- (1) Hold wiring connector in switch opening.
- (2) Push switch on to wiring connector.
- (3) Continue to push until switch snaps into place.

Map Lamp Switch

Removal

- (1) Remove two (2) attaching screws.
- (2) Drop assembly down and remove wiring connector, then remove map lamp assembly.

Installation

- (1) Connect wiring connector to lamp assembly.
- (2) Position map lamp assembly to panel and install two (2) mounting screws.

Glove Box Lamp Switch

Removal

- (1) Open glovebox until stops in bin rest against instrument panel, depress stops to clear instrument panel and continue pivoting glovebox assembly downward.
- (2) Disconnect wire to switch.
- (3) Snap switch out of panel.

Installation

- (1) Snap switch into panel.
- (2) Connect wire to switch.
- (3) Depress stops and close glove box door.

Overdrive Lockout Switch (Fig. 4)

Removal

- (1) Remove instrument cluster faceplate retaining screws and pull back from instrument panel.
- (2) Reach behind faceplate and disconnect lockout switch connector.

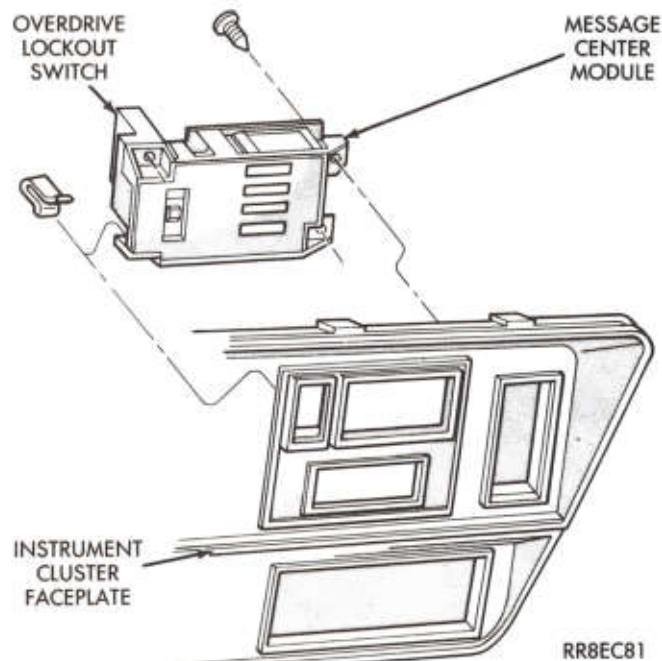


Fig. 4—Overdrive Lockout Switch and Message Center Module

(3) Depress retaining tabs on top and bottom of switch and pull switch out of module.

Installation

- (1) Position lockout switch into module and push until retaining tabs lock into place.
- (2) Connect switch connector.
- (3) Install instrument cluster faceplate to panel.

MESSAGE CENTER MODULE (Fig. 4)

Removal

- (1) Remove instrument cluster faceplate retaining screws and pull back from instrument panel.
- (2) Reach behind faceplate and disconnect lockout switch and message center connectors.
- (3) Remove module retaining screws (3) and clip (1) and pull module from faceplate.
- (4) Remove overdrive lockout switch from module.

Installation

- (1) Install overdrive lockout switch into module.
- (2) Position module on faceplate and install screws and clip.
- (3) Connect lockout switch and message center connectors.
- (4) Install instrument cluster faceplate to panel.

FUSEBLOCK AND FLASHERS

Fuseblock

The fuseblock is located directly below the steering column.

Removal

(1) Push fuseblock locking tab on column cover downward and lower fuseblock.

The following components plug into the fuseblock.

- (1) Fuses.
- (2) 30 amp circuit breaker.
- (3) Turn signal flasher.
- (4) Horn relay.

Installation

- (1) Position fuseblock to steering column cover.
- (2) Push locking tab to lock fuseblock in position.

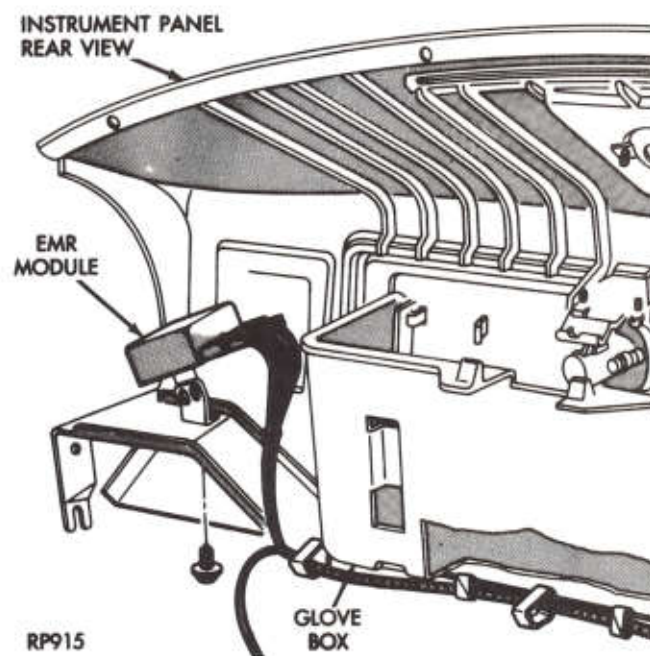


Fig. 5—Emission Maintenance Reminder Module

EMISSIONS MAINTENANCE REMINDER MODULE (Fig. 5)

Removal

- (1) Open glovebox past stops.
- (2) Locate module on right side of glovebox opening.
- (3) Remove electrical connector.
- (4) Lift module off of bracket.

Installation

- (1) Slide module onto bracket.
- (2) Install electrical connector.
- (3) Close glovebox door.

HOOD RELEASE

Removal

(1) Disengage cable from hood latch in engine compartment.

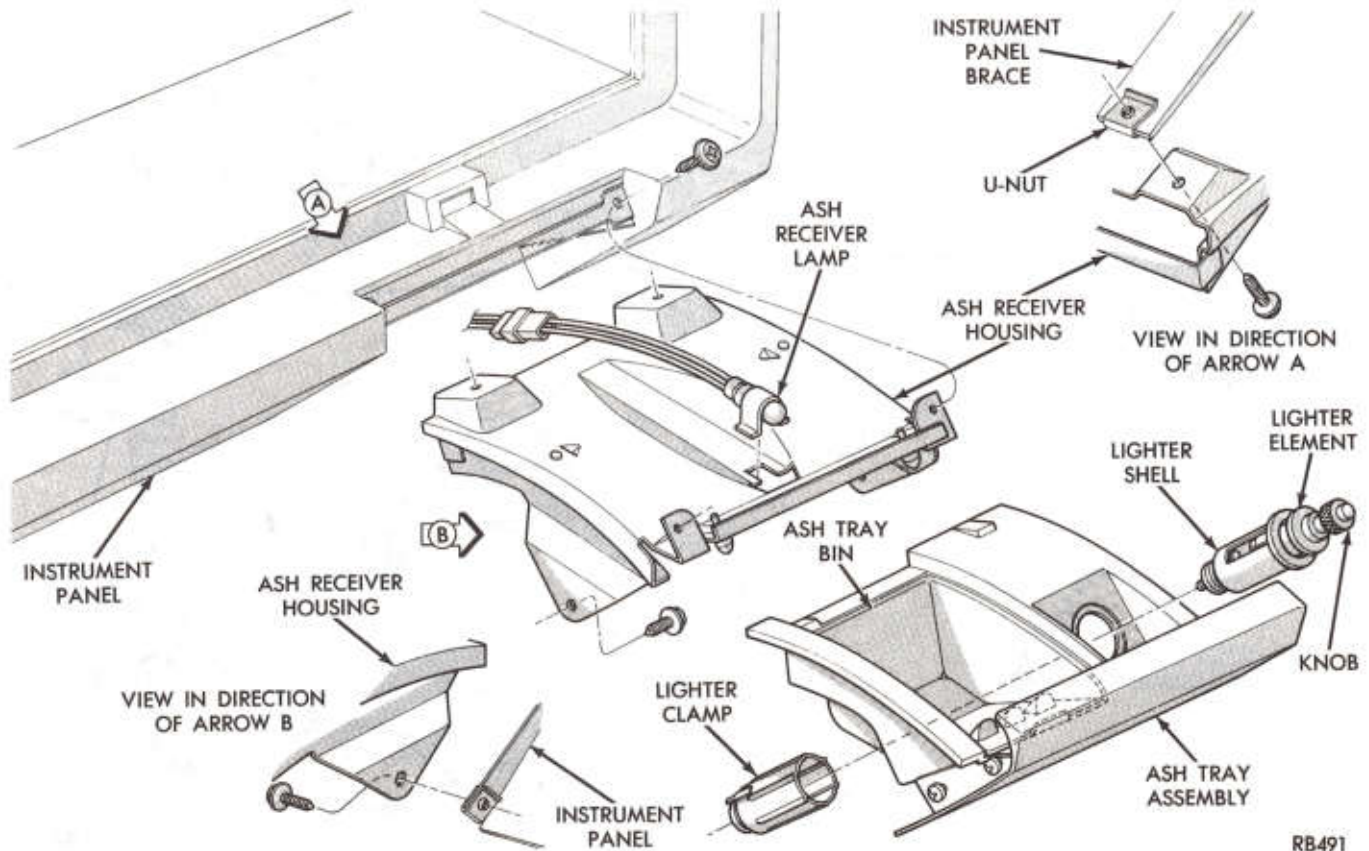


Fig. 6—Cigar Lighter and Ash Tray

(2) Remove handle assembly from instrument panel four (4) screws.

(3) Remove assembly by pulling cable rearward through dash panel grommet.

Installation

(1) Feed cable assembly forward through dash panel grommet.

(2) Mount handle assembly to instrument panel with four (4) screws.

(3) Connect cable to hood latch.

FOUR WHEEL DRIVE INDICATOR

Removal

(1) Remove faceplate.

(2) Remove two (2) screws and remove indicator from faceplate.

Installation

(1) Position indicator to faceplate and attach with two (2) screws.

(2) Install faceplate.

CIGAR LIGHTER (Fig. 6)

Removal

(1) Open ash receiver.

(2) Remove lighter element from shell.

(3) Turn clamp counterclockwise and remove.

(4) Remove shell through front of housing.

(5) Disconnect wiring.

Installation

(1) Connect wiring to shell.

(2) Insert shell through front of housing.

(3) Install clamp on shell, turn clockwise and tighten securely.

(4) Install lighter element.

(5) Install wires and close ash receiver.

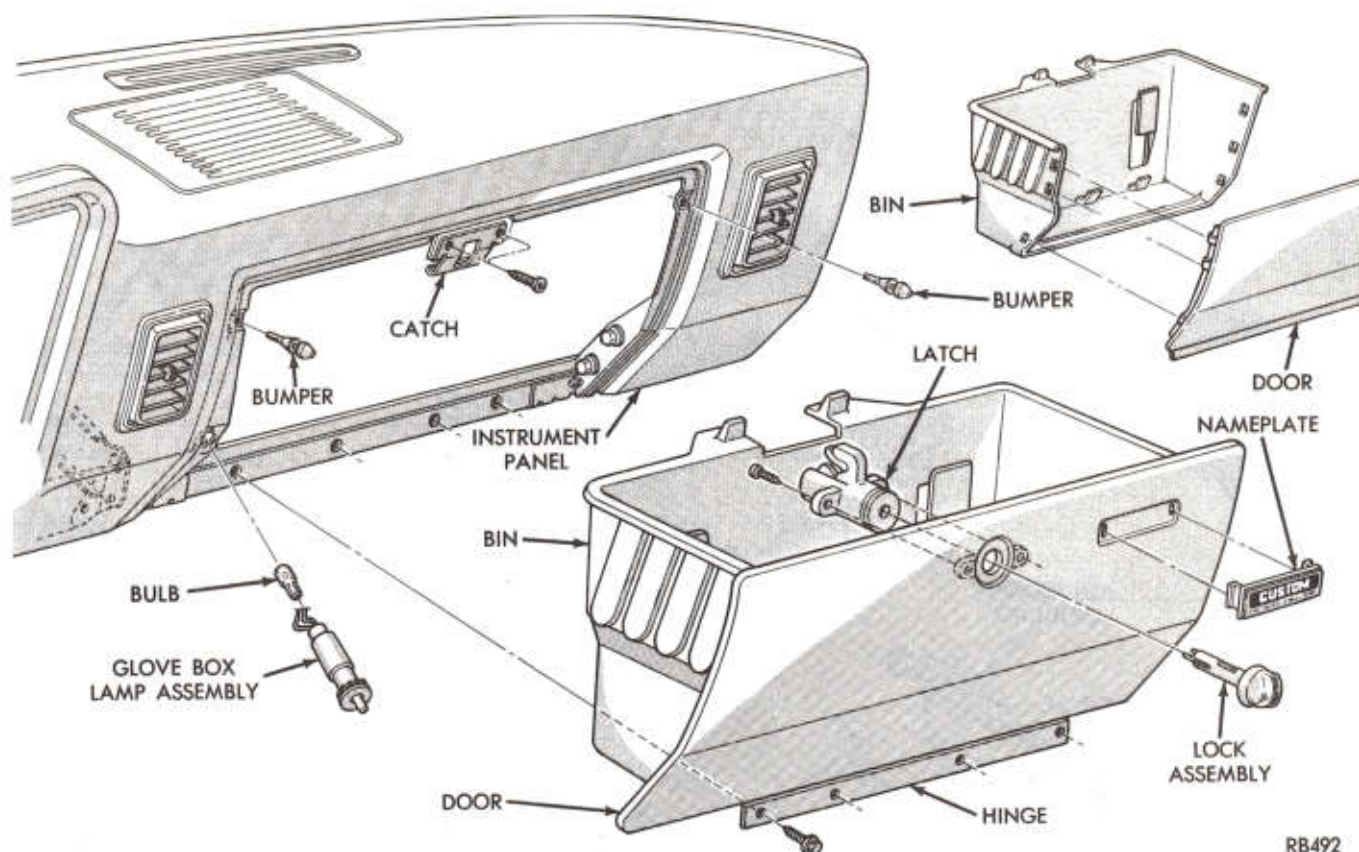
ASH TRAY (Fig. 6)

Tray

Removal

(1) Open ash tray.

(2) Remove ash tray bin.



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Fig. 7—Glove Box and Bin

Installation

- (1) Install ash tray bin.
- (2) Push ash tray inwards to closed position.

Housing**Removal**

- (1) Remove ash tray bin.
- (2) Disconnect electrical leads from cigar lighter.
- (3) Remove six (6) screws retaining housing to panel.
- (4) Remove cigar lighter from housing.

Installation

- (1) Install cigar lighter in housing.
- (2) Connect electrical leads to cigar lighter.
- (3) Position housing to panel and install six (6) mounting screws.
- (4) Install ash tray bin.

GLOVE BOX (Fig. 7)**Door and Bin Assembly****Removal**

- (1) Remove four (4) screws that retain glovebox to lower reinforcement.
- (2) The bin is removed by unsnapping bin from door assembly.

Installation

- (1) Snap bin onto door.
- (2) Mount assembly to lower reinforcement with four (4) mounting screws.

Glove Box Lock**Removal**

- (1) Open glove box door.
- (2) Turn lock into locked position and remove key.
- (3) Insert a stiff wire in rear slot of lock mechanism and depress retaining tumbler into cylinder.
- (4) While holding tumbler down with wire in lock cylinder, insert key.
- (5) Remove wire and pull out lock cylinder.
- (6) Remove latch mounting screws and remove assembly.

Installation

- (1) Position latch assembly into place on glove box door, install mounting screws and tighten securely.
- (2) Depress retaining tumbler into lock cylinder and insert key.
- (3) Position assembly so that it will be in the closed position when installed.
- (4) Push lock cylinder into latch assembly, and remove key.

Catch**Removal**

- (1) Open glove box door.
- (2) Remove catch mounting screws.
- (3) Remove catch.

Installation

- (1) Position catch and spring nut into place, install mounting screws and tighten securely.
- (2) Close glove box door.

ILLUMINATION BULB REPLACEMENT**Headlamp and Wiper Switch Lamp****Removal**

- (1) Remove cluster faceplate.
- (2) Remove headlamp switch knob and shaft by depressing release button on switch from under the panel.
- (3) Remove wiper switch knob by pulling knob off stem.
- (4) Remove bezel three (3) screws.
- (5) Remove bulb.

Installation

- (1) Replace bulb.
- (2) Install three (3) bezel screws.
- (3) Push on wiper knob.
- (4) Push in headlamp knob and shaft.
- (5) Install cluster faceplate.

Snow Plow Controls Illumination Lamp**Removal**

- (1) Remove two (2) screws on right side of snow plow control housing.
- (2) Loosen two (2) screws on left side of housing and slide housing to the right and pull away from instrument panel.
- (3) Remove four (4) screws holding bezel to housing.
- (4) Pull rearward and remove lamp bulb and socket.

Installation

- (1) Install lamp bulb and socket.
- (2) Position bezel to housing and install four (4) screws.

- (3) Position housing onto left side screws (2), install right side screws (2) and secure housing to instrument panel.

Ash Tray Illumination Lamp**Removal**

- (1) Open ash receiver and remove bin.
- (2) Disconnect wires from cigar lighter.
- (3) Remove six (6) screws that retain assembly to panel.
- (4) While dropping ash receiver, remove lamp assembly from top of the housing.

Installation

- (1) Install lamp assembly into top of housing.
- (2) Position housing and install six (6) mounting screws.
- (3) Connect wires to cigar lighter.
- (4) Install bin and close ash receiver.

Map Lamp Bulb

To replace bulb, snap lens out, replace bulb.

Four Wheel Drive Indicator**Removal**

- (1) Remove faceplate.
- (2) Remove bulb and socket.

Installation

- (1) Snap in bulb and socket.
- (2) Replace faceplate.

Heater or Heater A/C Illumination Lamp**Removal**

- (1) Remove cluster faceplate.
- (2) Remove two (2) control attaching screws.
- (3) Pull control rearward.
- (4) Snap out illumination lamp.

Installation

- (1) Install bulb into socket.
- (2) Snap socket into control.
- (3) Push control forward and install two (2) attaching screws.
- (4) Install cluster faceplate.

RADIO, ANTENNA AND SPEAKERS

INDEX

	Page		Page
Antenna Service Procedures	2	Radio Replacement	4
Bench Test for Antenna Malfunction	4	Installation	4
Installation	3	Removal	1
Removal	1	Radio Schematics	5
Testing	1	Speakers	5
General Information	1	Door Mounted	4
Interference Elimination	1	Instrument Panel Mounted	5
Radio Diagnosis	2	Rear Mounted	5

GENERAL INFORMATION

For operation of the factory installed standard and optional radios available, refer to the Owner's Manual supplied with the vehicle.

RADIO SCHEMATICS

Radio repair service and schematic wiring diagrams are available through Technical Service, Chrysler Huntsville Division, 102 Wynn Dr., Huntsville, AL 35805.

INTERFERENCE ELIMINATION

A number of components are utilized on vehicles equipped with a radio to suppress radio frequency interference (static).

(1) Capacitors are mounted in the following locations:

- Inside the alternator integral with the output stud (Fig. 1).



Fig. 1—Alternator Suppression Capacitor

- Internal to the instrument cluster at the input to the voltage limiter.
- On coil mounting screw with the lead connected to the positive primary terminal of the coil (Fig. 2).

(2) Ground straps are utilized from cab to box.

All of the above Capacitors and Ground Straps should be securely mounted to a clean ground surface to work effectively.

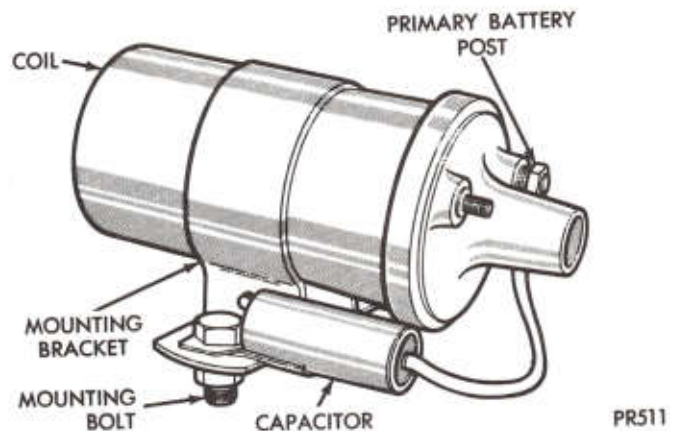


Fig. 2—Ignition Coil Suppression Capacitor

Radio resistance spark plug wires complete the interference suppression system. Faulty or deteriorated spark plug wires should be replaced (Fig. 3).



Fig. 3—Resistance Type Spark Plug Cables

ANTENNA

Testing (Fig. 4)

Antenna performance may be tested by substituting a known good antenna. It is also possible to check short or open circuits with an ohmmeter or continuity light once the antenna cable is disconnected from the radio as follows:

- Continuity should be observed between the tip of the mast and radio end pin.
- No continuity or a very high resistance of several megohms should be observed between the ground shell of the connector and radio end pin.

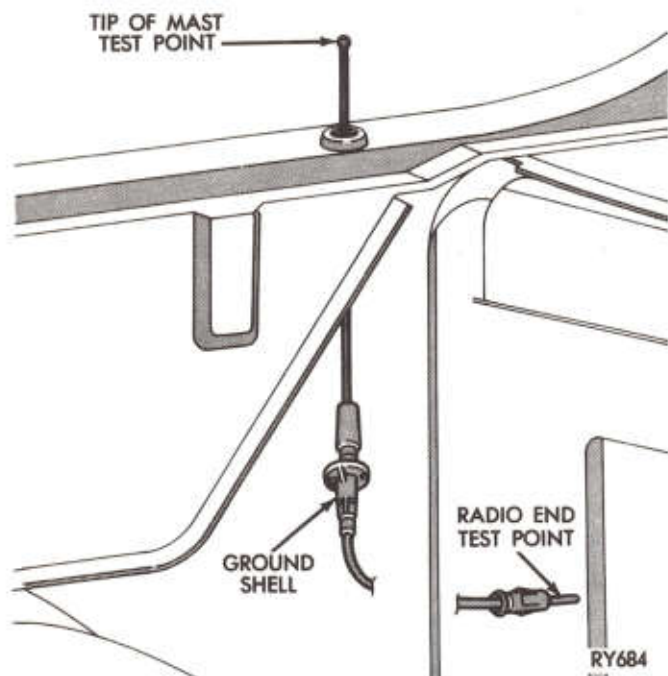
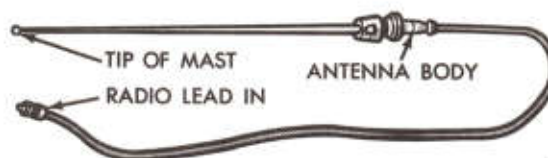


Fig. 4—Antenna Test Points

(3) Continuity should be observed between the ground shell of the connector and the mounting hardware on the fender.



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Fig. 5—Antenna Bench Test Points

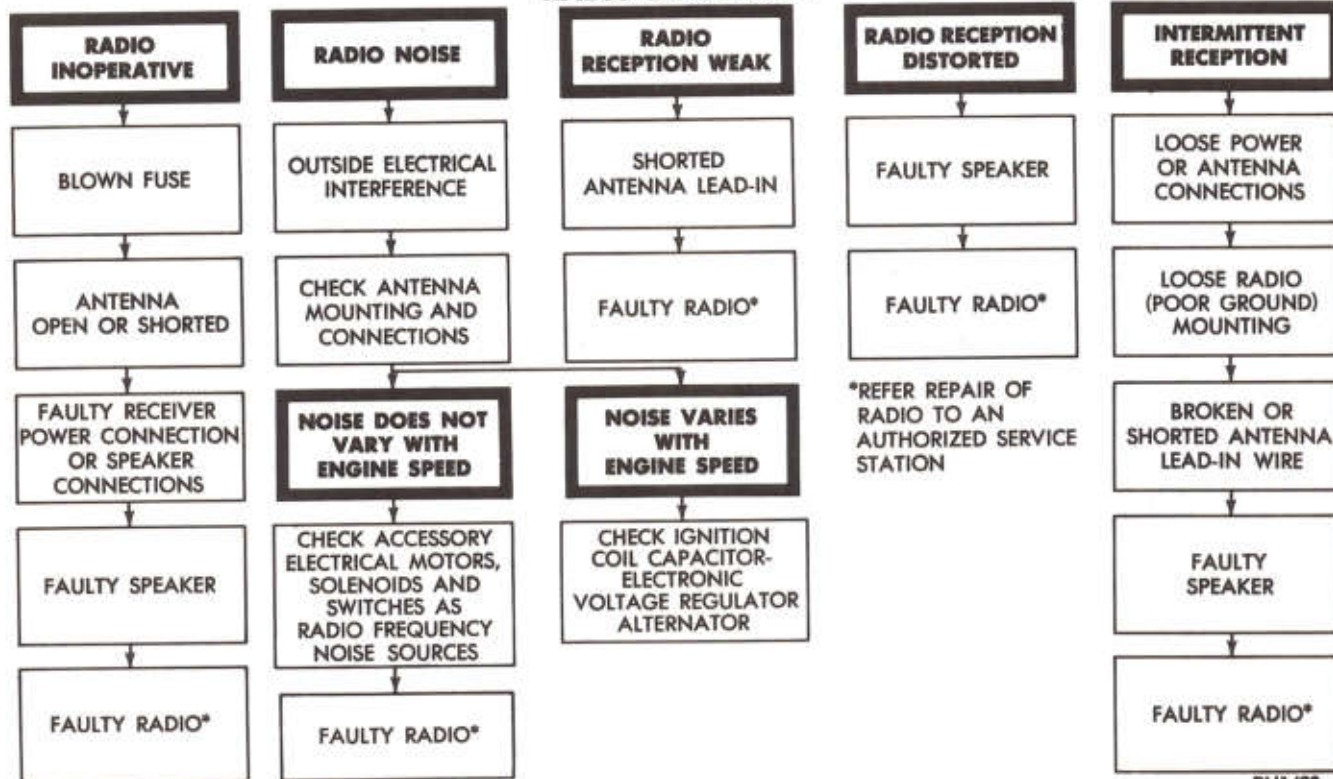
Bench Test for Antenna Malfunction (Fig. 5)

(1) With test lamp and battery in circuit attach one test lead to concentric pin on "lead-in" connector and other test lead to tip of mast. The lamp should "light" indicating Continuity.

(2) Keeping one lead on connector pin, clip other lead on antenna body assembly. The lamp should "not light." If it does, look for a short circuit in the body or in the cable probably at the connector.

(3) Remove clip lead from connector pin and clip on outer shell of connector. Connect other clip lead to antenna body assembly. The lamp should "light" again. If it does not "light", antenna shielding has an open circuit.

Wiggle cable over its entire length to reveal intermittent short or open circuits during steps 1, 2 and 3.

RADIO DIAGNOSIS

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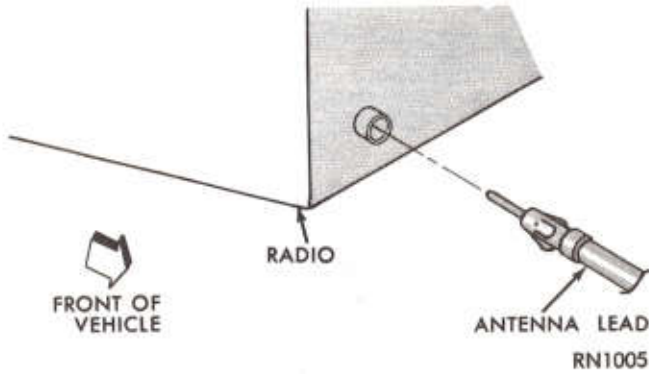


Fig. 6—Unplugging Antenna Lead from Radio

Removal

- (1) Disconnect fusible link in engine compartment.
- (2) Remove glove box.
- (3) Reach behind instrument panel and unplug antenna cable from radio (Fig. 6).

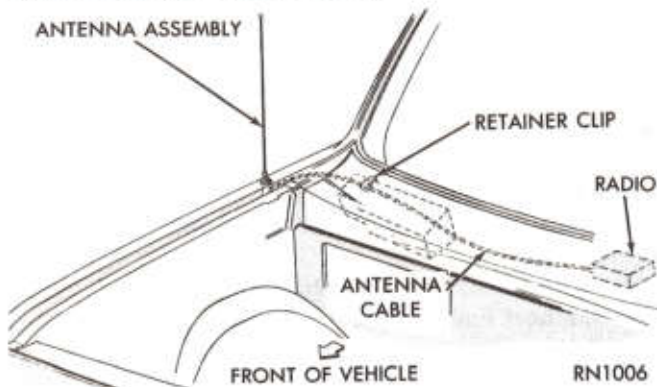


Fig. 7—Removing Antenna Cable

- (4) Working through the glove box opening, pull antenna cable from retainer clip (Fig. 7).

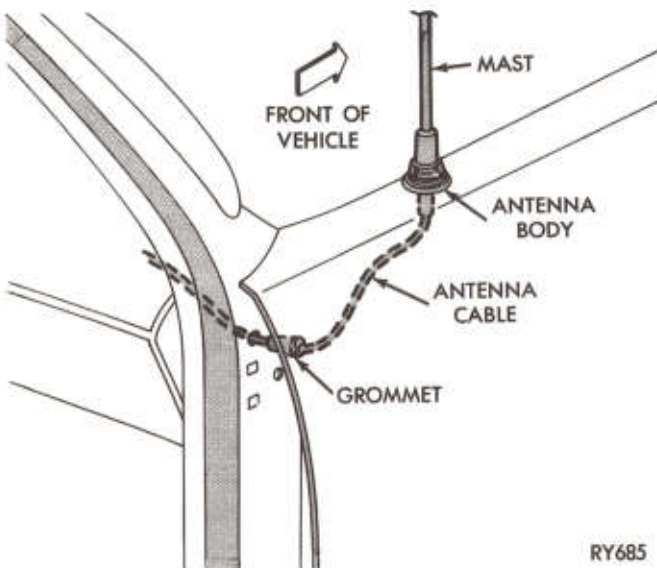


Fig. 8—Removing Grommet

- (5) Open right door and remove cable grommet from "A" post, (Fig. 8).

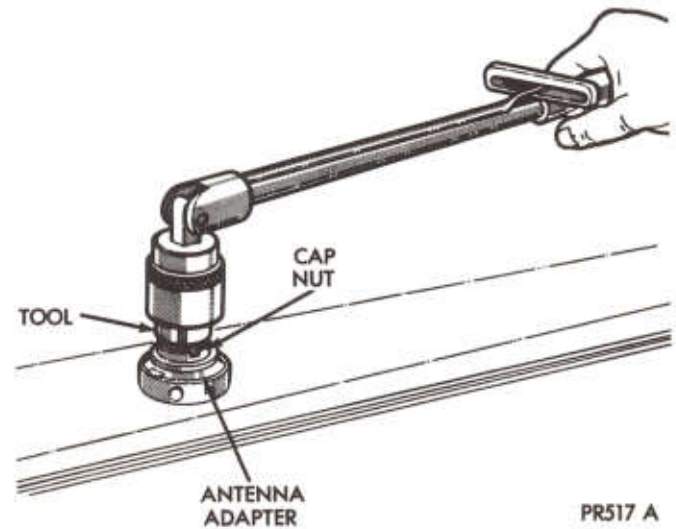


Fig. 9—Cap Nut and Adapter

- (6) Pull cable from "A" post.
- (7) **Loosen** antenna mast from antenna body. **Do not remove at this time.**
- (8) Loosen cap nut using tool C-4816 (Fig. 9).
- (9) While holding antenna mast with one hand, remove cap nut with other hand.
- (10) Lower antenna assembly down far enough to gain access to antenna body, (Fig. 10).
- (11) While holding body remove antenna mast.
- (12) Pull antenna body and cable assembly from fender area and remove.
- (13) Remove adapter on fender.

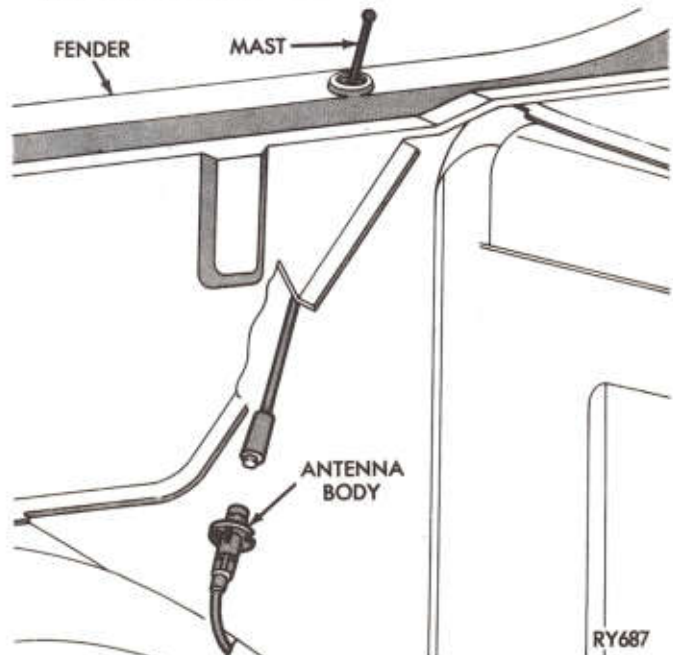


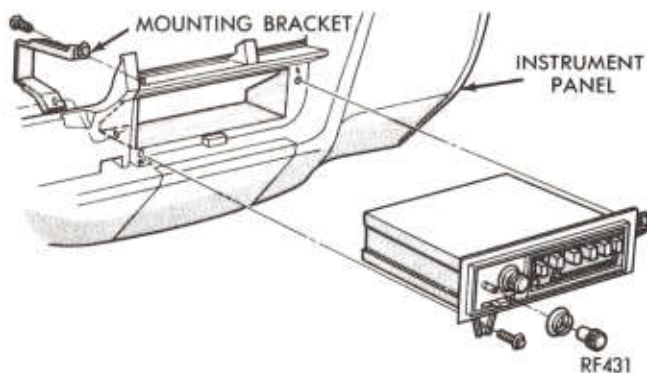
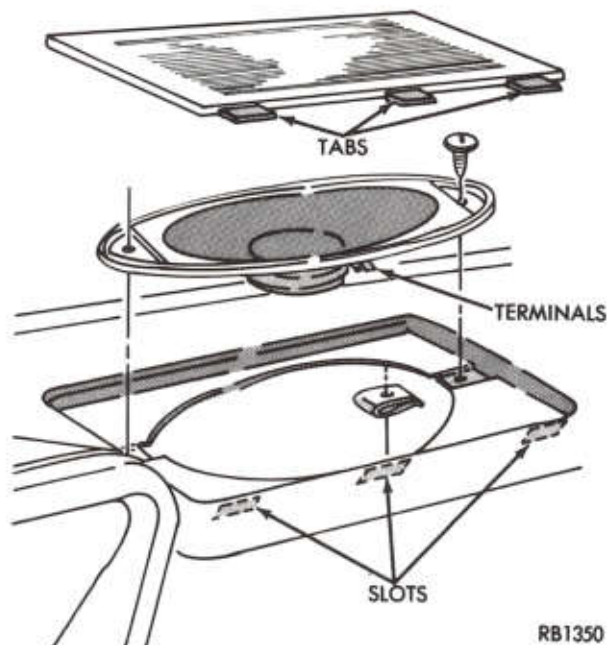
Fig. 10—Removing or Installing Antenna Body

Installation

- (1) Route antenna cable between fender and fire-wall to "A" post area.
- (2) Insert antenna mast through hole in fender and screw into antenna body.
- (3) Pull assembly up and position into place and hold.
- (4) Install adapter making sure tab indexes with opening in fender and antenna body.
- (5) Install cap nut and tighten securely with tool C-4816.
- (6) Insert cable through opening in "A" post and from inside glove box opening pull in far enough to snap grommet into place.
- (7) Route cable through retainer clip, over to radio, and plug into back of radio.
- (8) Install glove box.
- (9) Connect fusible link.

RADIO REPLACEMENT (Fig. 11)**Removal**

- (1) Disconnect fusible link in engine compartment.
- (2) Remove instrument cluster bezel. Refer to Instrument Panel Section of this group.
- (3) Remove two mounting screws from front of radio.
- (4) Pull radio out of instrument panel and disconnect wiring and antenna.
- (5) Remove screw from ground strap.

**Fig. 11—Radio to Instrument Panel Mounting****Fig. 12—Instrument Panel Speaker****Installation**

- (1) Install ground strap.
- (2) Install wiring and antenna.
- (3) Insert radio into panel and install mounting screws.
- (4) Install instrument cluster bezel.
- (5) Connect fusible link.

INSTRUMENT PANEL SPEAKER (Fig. 12)**Removal**

- (1) Remove speaker grille.
- (2) Remove speaker mounting screws.
- (3) Lift speaker from panel and disconnect wiring.
- (4) Remove speaker.

Installation

- (1) Position speaker with terminals facing to the right.
- (2) Install mounting screws.
- (3) Install speaker grille.

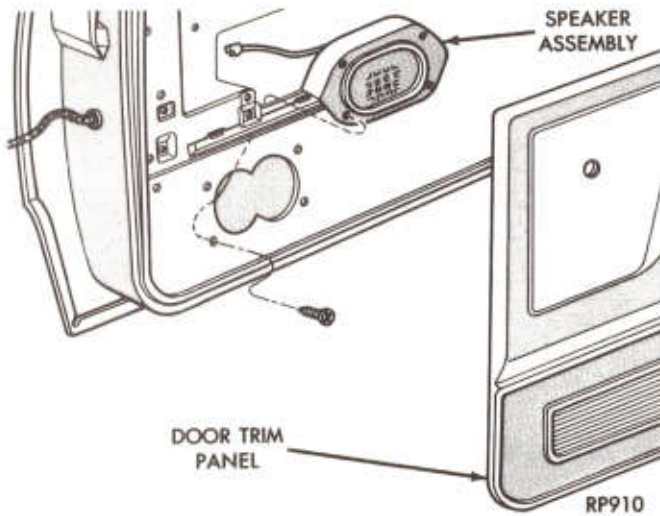


Fig. 13—Door Mounted Speaker

DOOR MOUNTED SPEAKER (Fig. 13)

Removal

- (1) Remove door trim panel.
- (2) Remove screws holding speaker.
- (3) Disconnect speaker leads.
- (4) Remove speaker.

Installation

- (1) Connect leads to speaker.
- (2) Position speaker into place, install mounting screws and tighten securely.
- (3) Install door trim panel.

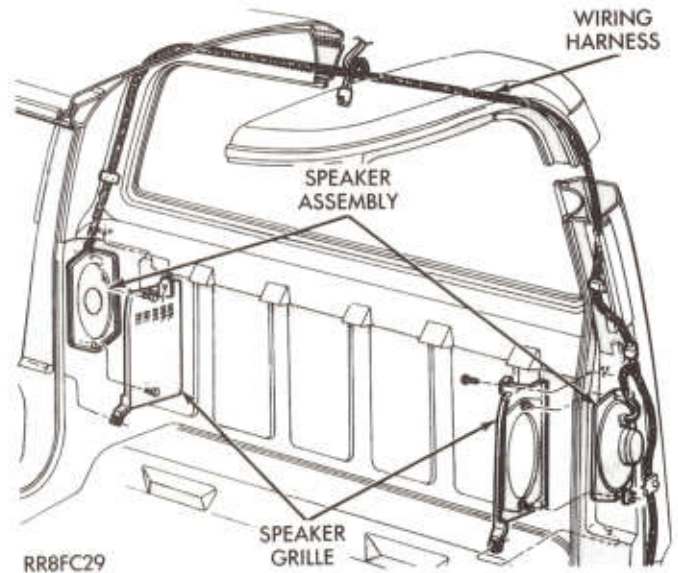


Fig. 14—Rear Speakers

REAR SPEAKERS (Fig. 14)

Removal

- (1) Remove speaker grille to pillar mounting screws (2).
- (2) Pull speaker and grille away from pillar and disconnect wiring.
- (3) Remove speaker to grille retaining nuts (2).

Installation

- (1) Position speaker onto studs of speaker grille and install nuts.
- (2) Install wiring harness connector on speaker.
- (3) Position speaker and grille on pillar and install mounting screws.

HORNS

INDEX

	Page		Page
General Information	1	Testing Procedures	1
Horn Diagnosis	2	Horns Sound Continuously	3
Horn Switch	3	Horns Will Not Sound	1
		Service Procedures	3

GENERAL INFORMATION

The horn system (Fig. 1) consists of a horn switch, horn relay (located on the fuse block), horns, and all their wiring and connections. The circuit is fed from the fuse box and grounded in the horn switch. When the horn switch on the steering column is pressed, the ground circuit is completed, energizing the relay, and supplying power to the horns.

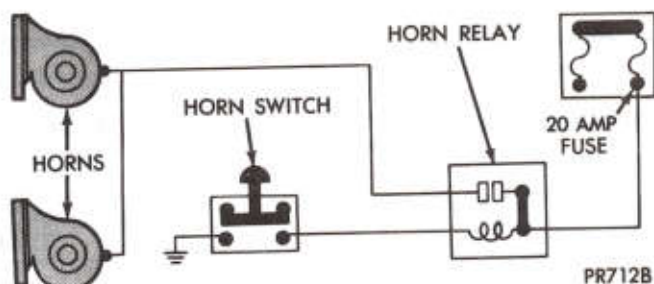


Fig. 1—Horn System

TESTING PROCEDURES

Horns Will Not Sound

If the horns do not sound, check for a blown horn fuse cavity #7 in the fuse block. If the fuse is blown, replace it with the same fuse type. In case the horns fail to sound, and the newly replaced fuse blows when depressing the horn switch, a short circuit in the horn or the horn wiring between the fuse terminal and the horn is responsible.

If the fuse is intact, remove horn pad assembly from steering wheel and, using an ohmmeter, verify continuity between the steering shaft and a good body ground. If ground checks out good, proceed to next test. If ground is not present, check to be sure that tabs on column bearing retainer plate are contacting inner race of column bearing.

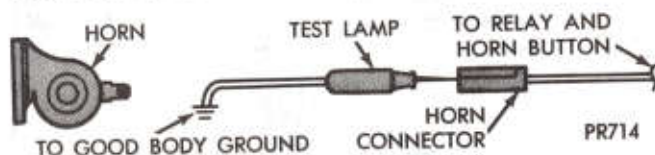


Fig. 2—Testing for Good Ground

Disconnect wire connector at horn and connect one lead of a test lamp to the wire connector and the other lead to a good body ground (Fig. 2). Depress the horn switch. Should test lamp illuminate, the horn is ungrounded or faulty. Grounding can be verified by making a temporary jumper wire connection between horn bracket (scratch through paint) and negative battery terminal. If horn fails to sound with ground jumper intact, horn reconnected, and horn button or rim depressed, replace the horn.

If the lamp fails to illuminate, check for a defective horn relay by substituting a known good horn relay in the circuit. If the lamp illuminates when depressing the horn switch, the original relay is defective. If the lamp fails to illuminate with a known good relay, unplug that relay and connect a jumper wire from the battery terminal to the horn terminal on the relay connector (Fig. 3). (Refer to Horn Diagnosis chart for connector terminal identification). If the lamp, which is connected in place of the horns, fails to illuminate inspect for an open circuit between the horn fuse and

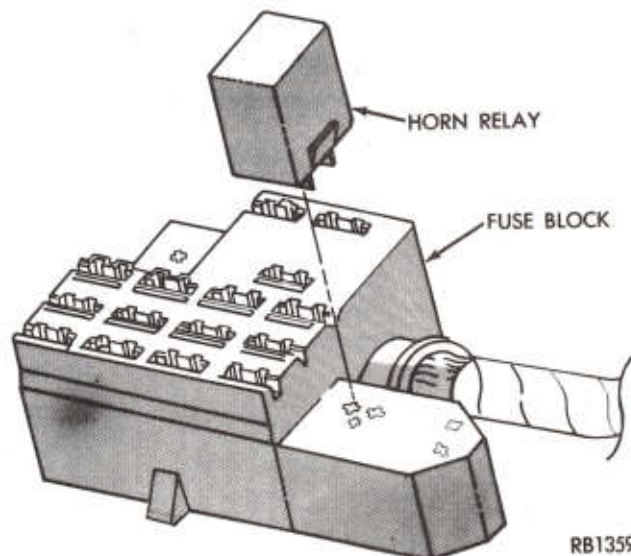
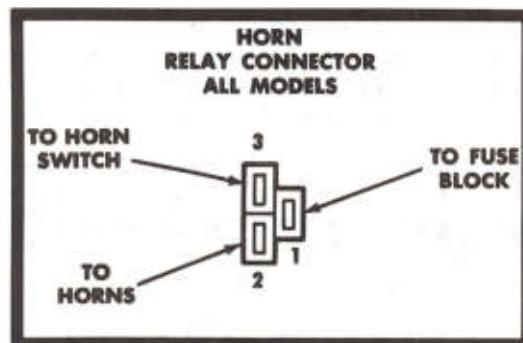
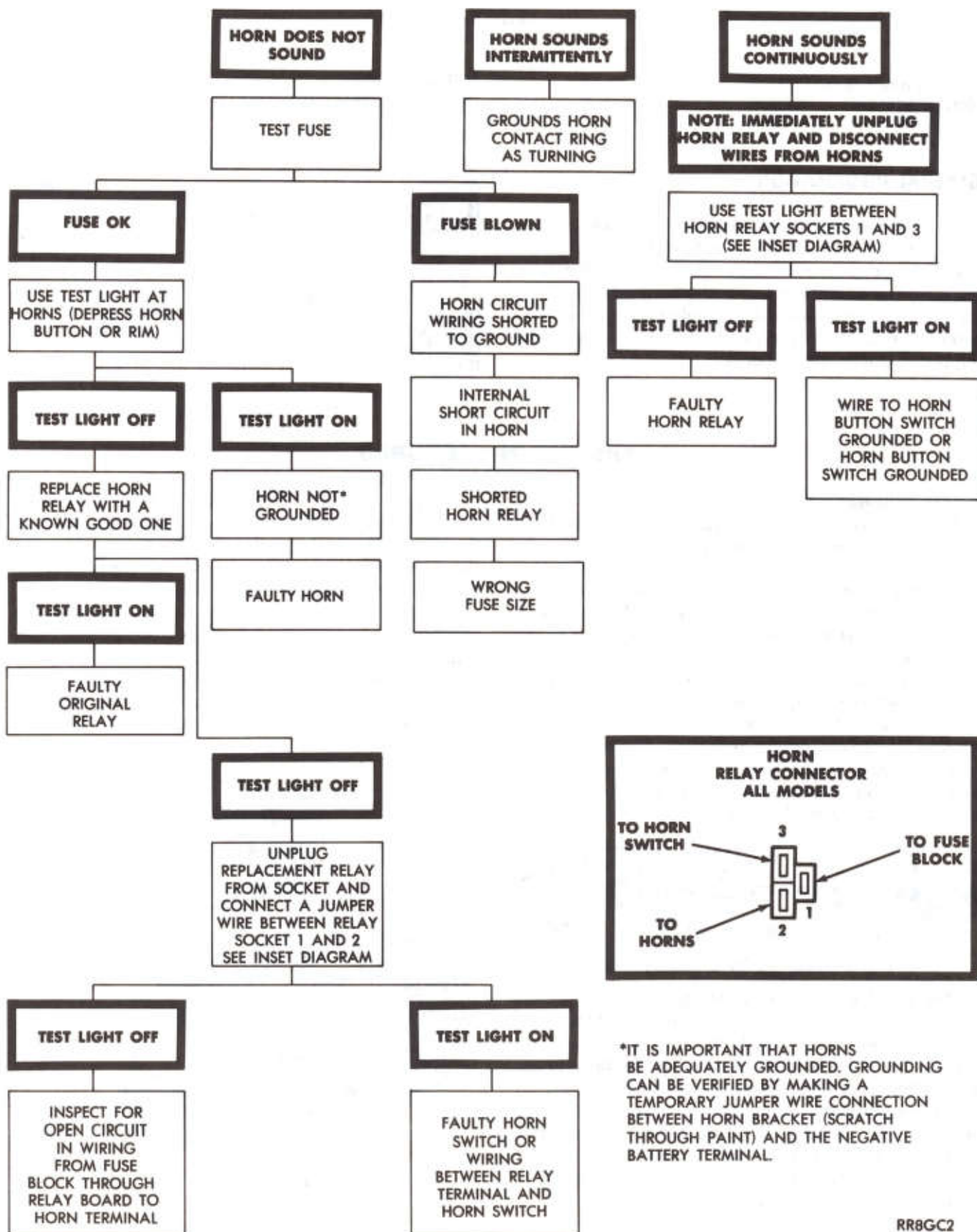


Fig. 3—Horn Relay

HORN DIAGNOSIS



*IT IS IMPORTANT THAT HORNS BE ADEQUATELY GROUNDED. GROUNDING CAN BE VERIFIED BY MAKING A TEMPORARY JUMPER WIRE CONNECTION BETWEEN HORN BRACKET (SCRATCH THROUGH PAINT) AND THE NEGATIVE BATTERY TERMINAL.

the horn terminal on the relay connector and between relay and the horn terminals.

Horns Sound Continuously

Should the horns sound continuously, unplug the horn relay from the fuse block inside the passenger compartment (Fig. 1). Plug in a known good relay. If the horns stop blowing, relay is defective and must be replaced. Should the horns still sound, proceed as follows: Connect one lead of test lamp to terminal "1"

on the relay connector and the other lead to terminal "3" (Refer to Horn Diagnosis chart for connector terminal identification). Should the lamp illuminate, either the wire is shorted to ground or the horn switch is defective.

Remove steering wheel pad and disconnect wire from horn switch. Repeat the above test and if the test lamp still illuminates, wire is shorted and should be repaired. If test lamp does not illuminate, horn switch is defective and must be replaced.

SERVICE PROCEDURES

HORN SWITCH (HORN PAD ASSEMBLY) REPLACEMENT

Steering Wheel Type I (Fig. 4)

Removal

- (1) From underside of steering wheel, remove two pad mounting screws.
- (2) Pull pad up from wheel and disconnect electrical leads.
- (3) Remove pad.

Installation

- (1) Connect electrical leads to pad terminals.
- (2) Position pad into place on steering wheel and secure pad with two screws.

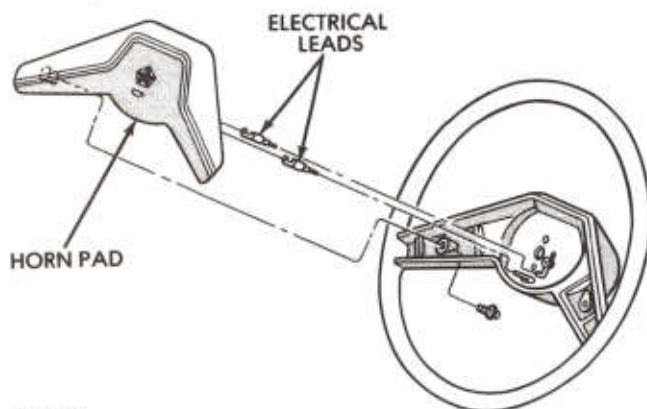


Fig. 4—Steering Wheel Type I

Steering Wheel Type II (Fig. 5)

Removal

- (1) Remove horn pad by prying from bottom, being careful not to mar the wheel surface.
- (2) Remove electrical leads from horn switches.
- (3) Remove screw retaining each horn switch to pad.

Installation

- (1) Position horn switches and secure to horn pad.
- (2) Connect electrical leads.
- (3) Snap horn pad into position on steering wheel.

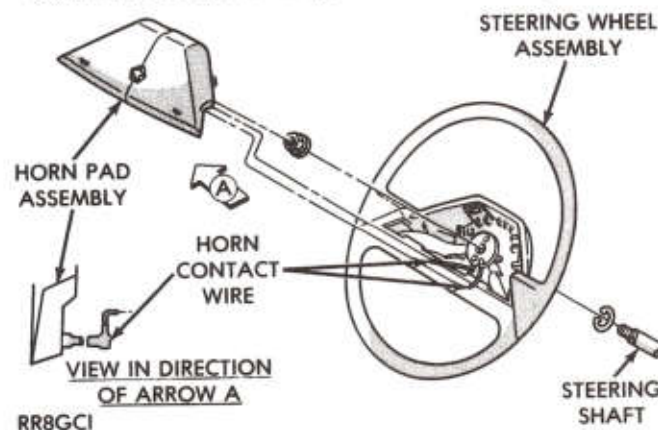


Fig. 5—Steering Wheel Type II

SPEED CONTROL SYSTEM

INDEX

	Page		Page
Adjustments		Test Procedures	
Servo Lock-in Screw	8	Clutch Switch	7
Speed Control Cable 3.9L and 5.2L	7	Electrical Tests at Servo	5
Speed Control Cable 5.9L	8	Grounding	5
General Information	1	Input to Servo	5
Service Procedures		Inoperative System	5
Servo Throttle Cable	10	Road Test	5
Servo Unit	9	Speed Control Switch	6
Speed Control Switch	9	Stop Lamp Switch	6
Speed Control System Diagnosis	3	Vacuum Supply	7

GENERAL INFORMATION

The speed control system (Fig. 1) is electrically actuated and vacuum operated. The turn signal lever on the steering column incorporates a slide switch which has three positions OFF, ON or RESUME. A SET button is located in the end of the lever. This device is designed to operate at speeds above approximately 30 mph (48 Km).

WARNING: THE USE OF "SPEED CONTROL" IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED OR SLIPPERY.

To engage: Move slide switch to the ON position, attain desired speed then momentarily depress and release SET button establishing speed memory and engaging system. Remove foot from accelerator. Speed will be maintained at this level. Moving the slide switch from OFF to ON while the vehicle is in motion establishes memory without system engagement at that speed.

To disengage: Normal brake application or a soft tap on the brake pedal will disengage control unit without

erasing speed memory. Moving the slide switch to the OFF position or turning the ignition OFF also disengages the system and in addition erases the speed memory.

To Resume: Momentarily move slide switch to the RESUME position. Vehicle will resume to the previously set speed.

To vary speed setting: To increase speed, depress accelerator to desired speed and momentarily depress and release SET button. When speed control system is engaged, tapping SET button may increase speed setting incrementally.

To decrease speed, tap brake pedal lightly disengaging system. When desired speed has been obtained depress and release SET button. Decrease in speed can also be attained by holding SET button depressed until desired speed is attained. Releasing the button engages the system at that speed.

To accelerate for passing: Depress accelerator as needed. When passing is completed, release accelerator and vehicle will return to previous speed setting.

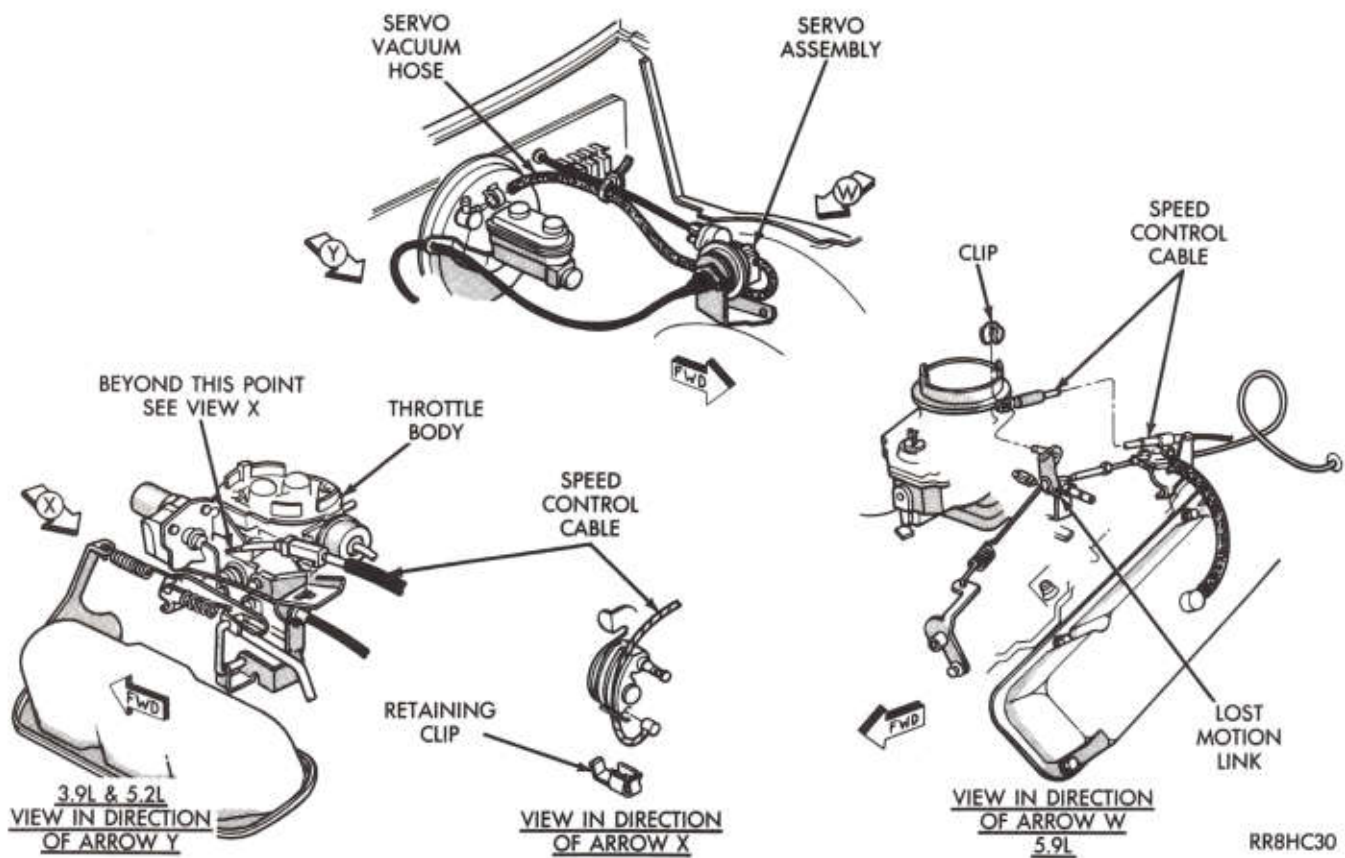
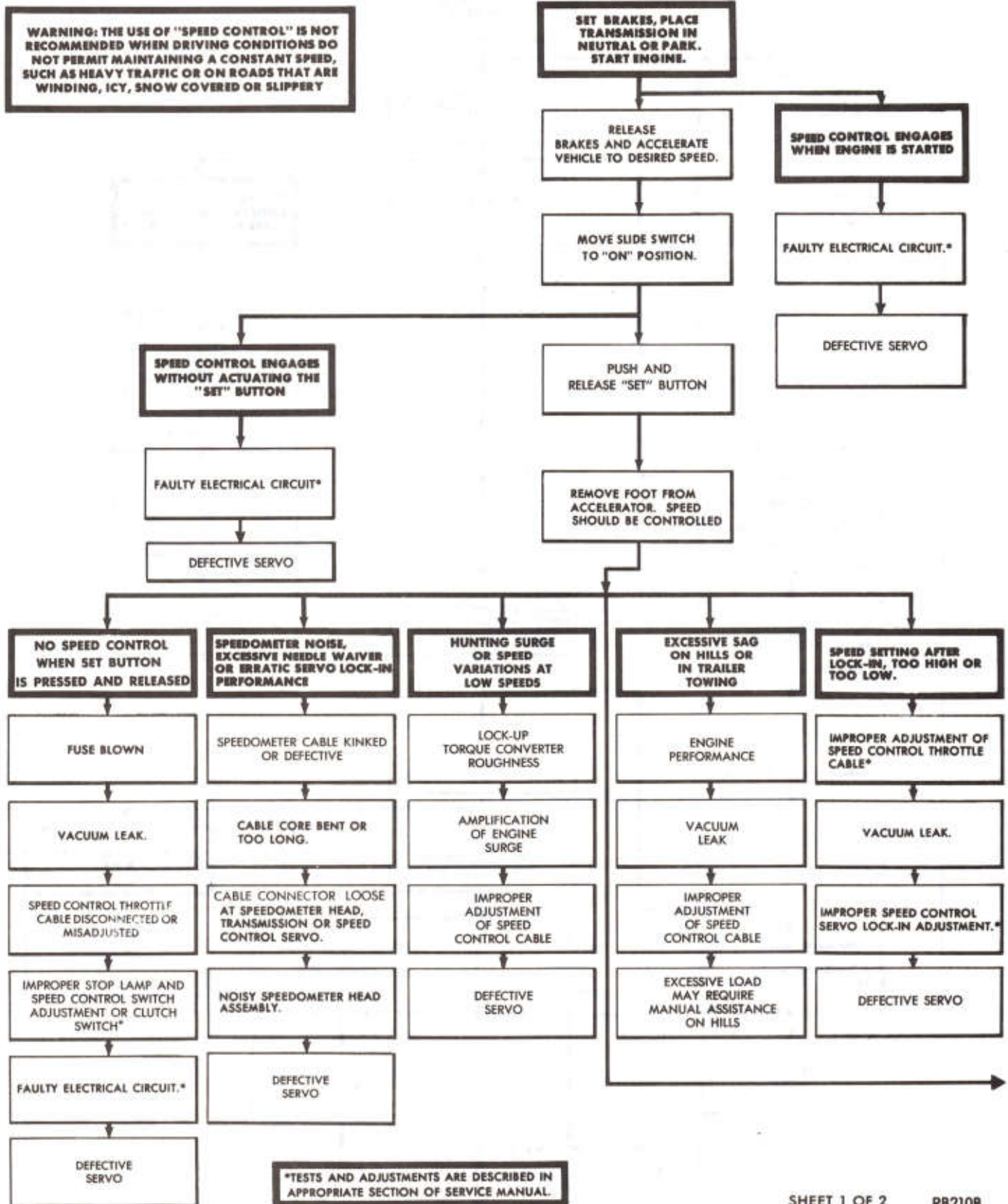
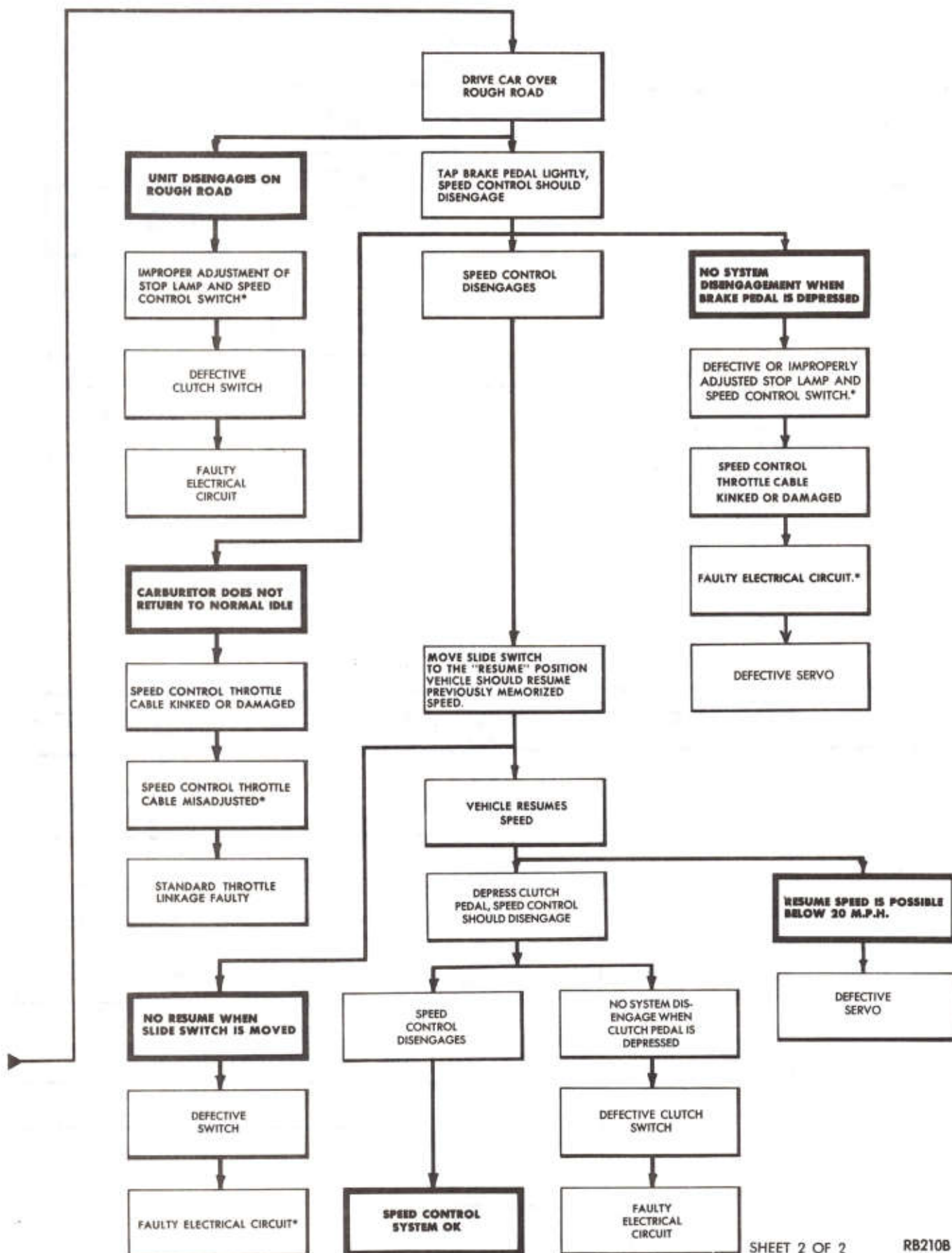


Fig. 1—Speed Control System

SPEED CONTROL SYSTEM DIAGNOSIS





TEST PROCEDURES

ROAD TEST

Road test vehicle to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

A broken or disconnected speedometer cable from the transmission to the speed control servo will disable both the speed control system and the speedometer. Flutter in the speedometer can indicate a problem which might cause surging in the speed control system. Speedometer deficiencies should be corrected before proceeding.

INOPERATIVE SYSTEM

If road test verifies a report of an inoperative system and of satisfactory speedometer operation, an inspection should be made for loose electrical connectors at the servo. Corrosion should be removed from terminals and a light coating of Mopar Multi-purpose grease or equivalent applied.

ELECTRICAL TESTS AT SERVO

The electrical tests at the servo are performed with a 12-volt test lamp with an alligator clamp at one end and a straight probe at the other.

Servo Electrical Grounding

The servo is grounded internally through the metal servo cover to the servo mounting bracket.

Check for a good servo ground before proceeding to other electrical tests.

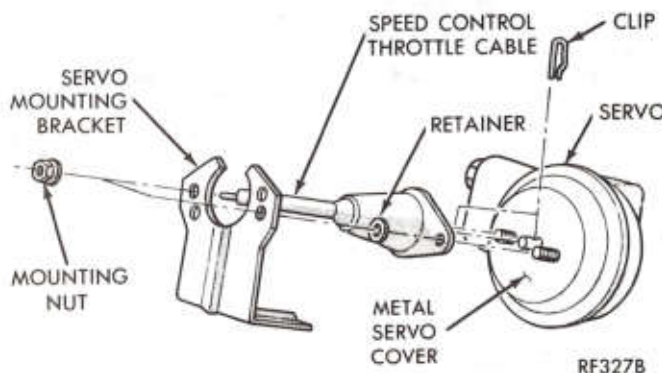


Fig. 2—Servo Grounding

Connect alligator clamp of test lamp to positive battery terminal and touch probe to the metal servo cover (Fig. 2). Lamp should light. If lamp fails to light, correct poor ground condition.

ELECTRICAL INPUT TO SERVO TEST

The electrical input to the servo should be checked at the servo terminals (Fig. 3).

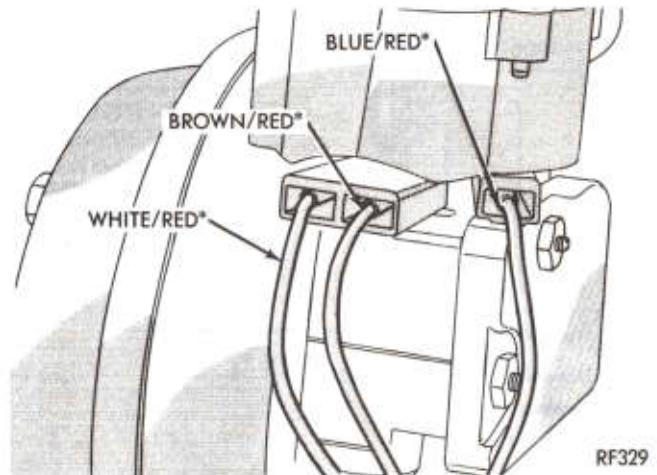


Fig. 3—Servo Terminals

Brown Wire with Red Tracer

(1) Connect test lamp between ground and brown wire with red tracer.

(a) Turn on ignition switch and speed control switch. Test light should be on.

(b) Push SET button. Test light should go out and a click should be heard at the servo.

(c) Release SET button. Test light should go back on and another click should be heard at the servo.

(2) If the test light does not respond properly there is a blown fuse, faulty wiring, or a defective speed control switch. If the clicks are not heard at the servo, the servo is defective.

White Wire with Red Tracer

(1) Connect test light between ground and white wire with red tracer.

(a) Turn on ignition switch and speed control switch. Test light should be off.

(b) Push SET button. Test light should be on while SET button is depressed.

(2) If the test light does not respond properly there is a defective speed control switch, or faulty wiring.

Blue Wire with Red Tracer

(1) Connect test light between ground and blue wire with red tracer.

(a) Turn on ignition switch and speed control switch. Test lamp should be on.

(2) If the test light does not respond properly, there is faulty wiring, brake switch, clutch switch, or speed control switch.

STOP LAMP SPEED CONTROL SWITCH TEST (Fig. 4)

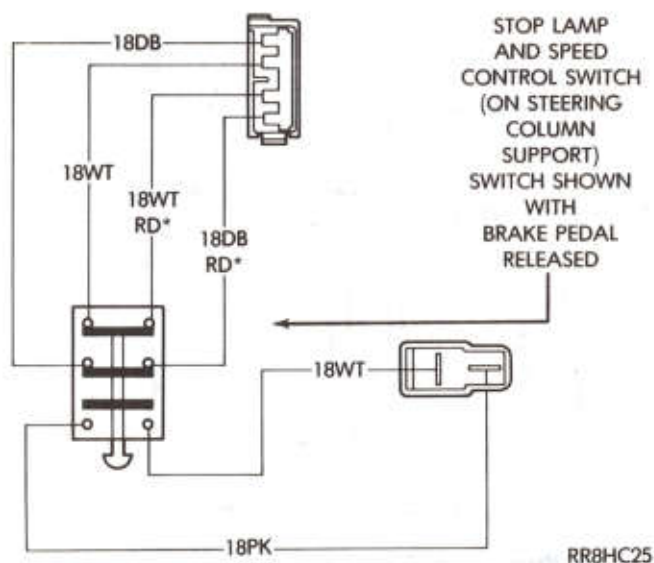


Fig. 4—Stop Lamp and Speed Control Switch Wiring

(1) Disconnect the two-cavity and four-cavity connectors at the stop lamp switch. Using an ohmmeter, continuity may be checked at the switch side of the connector as follows:

(a) With brake pedal released, there should be continuity (no resistance) between dark blue and red tracer (DB/RD*) and dark blue (DB) wires, and between white with red tracer (WT/RD*) and white (WT) wires (4-terminal connector). There should be no continuity between pink (PK) and white (WT) wires (2-terminal connector).

(b) With brake pedal depressed, there should be continuity between pink (PK) and white (WT) wires. There should be no continuity between dark blue with red tracer (DB/RD*) and dark blue (DB) wires, or between white with red tracer (WT/RD*) and white (WT) wires.

(2) If the above results are not obtained, the stop lamp switch is defective or out of adjustment.

(3) Stop lamp switch adjustment is detailed in Group 5, "Brakes."

SPEED CONTROL SWITCH (TURN SIGNAL LEVER) TEST (Fig. 5)

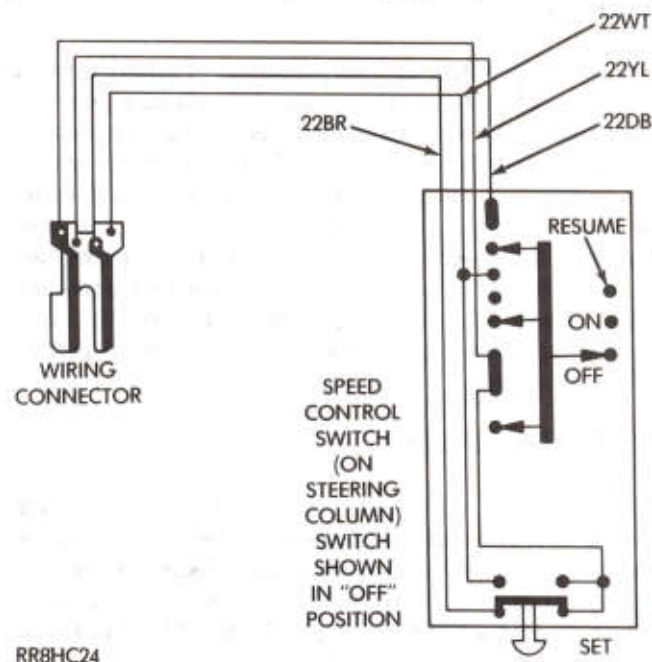


Fig. 5—Speed Control Steering Column Switch and Wiring

(1) Disconnect the blade-type four wire electrical connector at base of steering column.

(2) Using a continuity tester or an ohmmeter (do not use a test light), check for continuity at the connector wires. Results should be obtained according to the following chart.

(3) If these results are not obtained, replace the switch.

SPEED CONTROL SWITCH	
CONTINUITY CHART	
SWITCH POSITION	CONTINUITY BETWEEN
OFF	BR and YL
ON	BR and YL BR and DB YL and DB
SET	YL and WT DB and WT YL and DB/WT
RESUME	DB and WT DB and YL BR and YL BR and DB BR and WT

CLUTCH SWITCH TEST (Manual Transmission)

(1) Disconnect the double connector at the switch pigtail and connect a twelve volt source to either terminal. Connect a test lamp between the other terminal and a good ground. The test lamp should be on when the clutch pedal is in the free position. The test lamp should go off when the clutch pedal is depressed.

(2) If the test lamp does not respond properly, the clutch switch is defective.

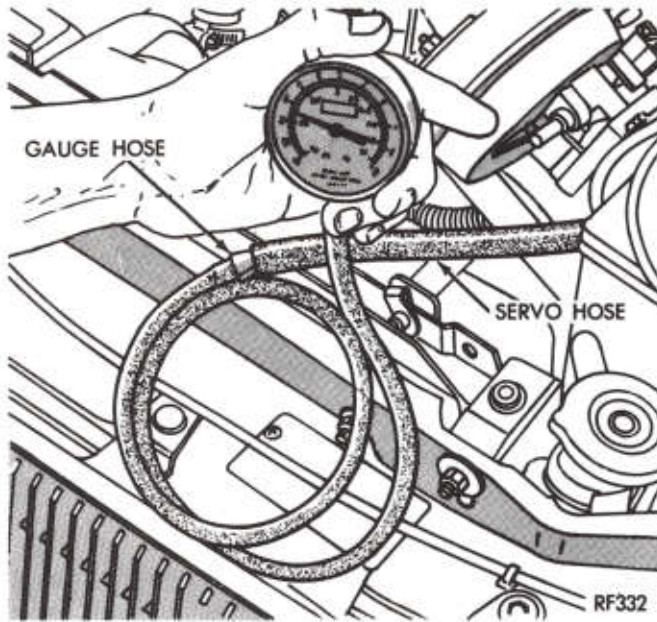


Fig. 6—Vacuum Gauge Test

VACUUM SUPPLY TEST

(1) Disconnect vacuum hose at the servo and install a vacuum gauge in the hose (Fig. 6).

(2) Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury.

(3) If vacuum does not meet this requirement, check for vacuum leaks or poor engine performance.

ADJUSTMENTS

Speed Control Cable Adjustment (3.9L and 5.2L)

The speed control cable on D-body trucks with the 3.9L and 5.2L engines is snapped into a T-shaped slot in the cable mounting bracket (Fig. 7).

(1) Grip cable core wire and lightly push toward servo.

(2) While lightly holding toward servo, mark core wire next to protective sleeve (Fig. 8).

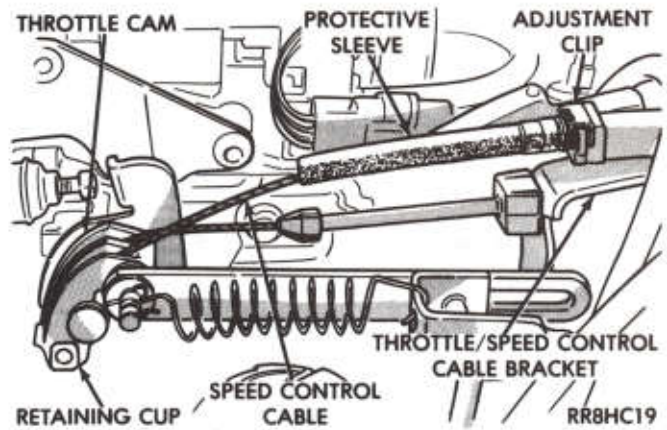


Fig. 7—Speed Control Cable and Mounting Bracket (3.9L and 5.2L)

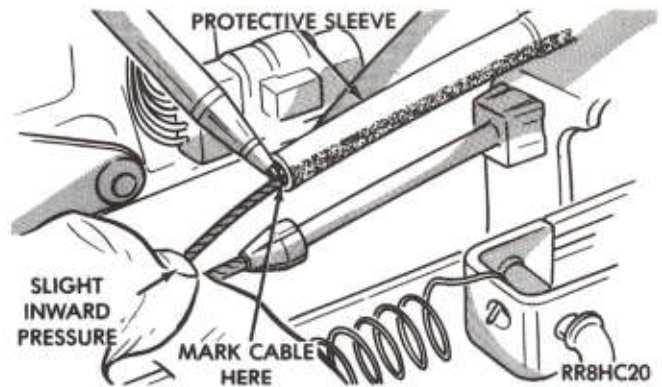


Fig. 8—Push Cable In and Mark at Protective Sleeve

(3) Pull core wire away from servo. There should be a 6mm (.24 in.) gap between the mark on the core wire and the protective sleeve (Fig. 9).

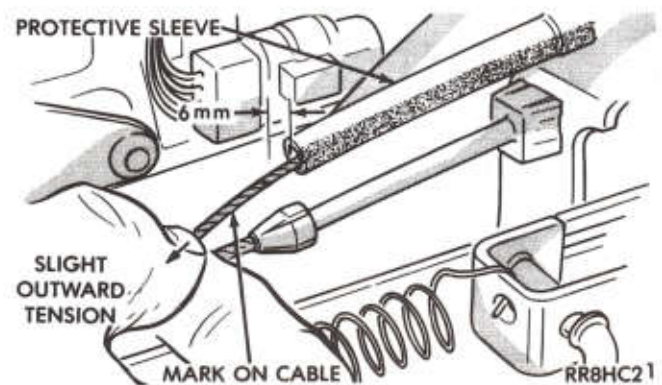


Fig. 9—Pull Cable Out and Measure from Mark to Protective Sleeve

- (4) If gap is not correct, remove adjustment clip and push protective sleeve into housing to decrease gap or pull sleeve out of housing to increase gap (Fig. 10).
- (5) Install adjustment clip.

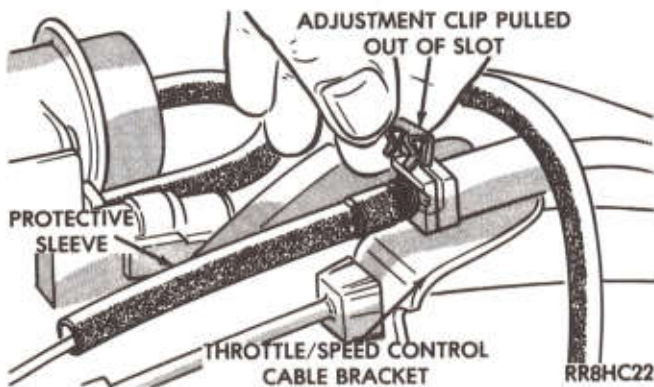


Fig. 10—Adjustment Clip Pulled Out of Slot to Move Sleeve

Speed Control Cable Adjustment (5.9L) (Fig. 11)

The speed control cable on D-body trucks with 5.9L engines is attached to a cable support bracket by a clip located approximately seven inches from the stud on the lost motion link.

- (1) Start engine and let run until it reaches operating temperature.
- (2) The carburetor should be at curb idle and the choke off.

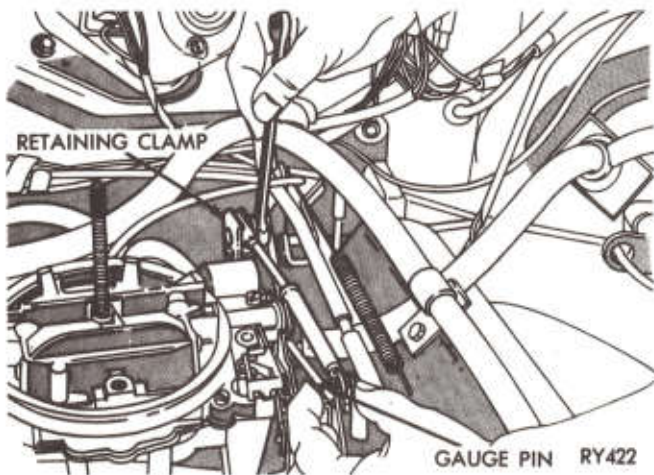


Fig. 11—Servo Throttle Cable Adjustment (5.9L)

- (3) Remove the spring clip from the lost motion link stud. The clearance between the stud and the cable clevis should be 1/16 inch (1.66mm).
- (4) Insert a gauge pin between the cable clevis and the stud.
- (5) Loosen clip at cable support bracket.
- (6) Pull all slack out of cable. Do not pull cable so tight that it moves throttle away from curb idle position.

- (7) Tighten clip at cable support bracket to 45 in. lb. (5 N·m).
- (8) Remove gauge pin and install spring clip on stud of lost motion link.

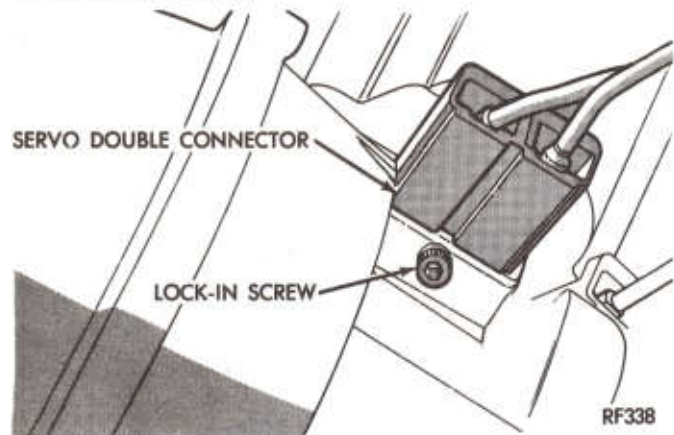


Fig. 12—Lock-In Screw Adjustment

Servo Lock-In Screw Adjustment

The Lock-in Screw Adjustment (Fig. 12) controls the Lock-in accuracy of the speed control unit. When the SET button is depressed and released at speeds above approximately 30 mph (50 km/h) the speed control system is activated, the system "locks in" and should hold the vehicle at virtually the same speed at which it is traveling.

Lock-in accuracy will be affected by:

- (a) Poor engine performance (need for tune-up, etc.)
- (b) Power to weight ratio (loaded gross weight of vehicle; trailering).
- (c) Improper slack in throttle control cable, (See "Speed Control Cable Adjustment").

This screw should never be adjusted indiscriminately. Need for adjustment can be determined only after accurate diagnosis of the Speed Control System operation.

After the steps (a) (b) and (c) have been considered and speed "sags" (drops) more than 2 to 3 mph (3 to 5 km/h) when speed control is activated, the lock-in adjusting screw should be turned counterclockwise approximately 1/4 turn per one mph (1.6 km/h) correction required. If "Pull-up" (speed increase) of more than 2 to 3 mph (3 to 5 km/h) occurs, the lock-in adjusting screw should be turned clockwise approximately 1/4 turn per one mph (1.6 km/h) correction required.

CAUTION: This adjustment must not exceed two turns in either direction or damage to unit may occur.

Speed Control Cable Attachment

(1) The clevis of the speed control cable is retained on carburetor throttle lever stud by a snap ring (with a throttle body, the cable is retained with a special retaining clip). Visual inspection will verify that the cable is securely attached. If the cable is not attached, the speed control system will be inoperative.

(2) The speed control cable is attached to the servo with a wire clip (Fig. 13). A check should be made to verify that the clip is in place. If the clip is missing the speed control system will be inoperative.



Fig. 13—Speed Control Cable Attachment at Servo

SERVICE PROCEDURES

SERVO UNIT

Removal

- (1) Remove two nuts attaching throttle cable and mounting bracket to servo.
- (2) Remove two screws attaching servo mounting bracket to U-Nuts on battery tray.
- (3) Remove servo mounting bracket.
- (4) Disconnect electrical connector and vacuum hose.
- (5) Pull cable away from servo to expose retaining clip and remove clip attaching cable to servo.

Installation

- (1) With throttle in full open position align hole in throttle cable sleeve with hole in servo pin and install retaining clip.
- (2) Connect vacuum hose to servo.
- (3) Connect electrical connector.
- (4) Position mounting bracket and install two screws attaching bracket to battery tray, tighten to 105 in. lbs. (12 N·m).
- (5) Insert servo studs through holes in throttle cable and mounting bracket.
- (6) Install nuts, tighten to 80 in. lbs. (9 N·m).

SPEED CONTROL SWITCH (Turn Signal Lever)

Removal

- (1) Disconnect negative battery cable.
- (2) Remove lower steering column cover.
- (3) Remove wiring trough after unsnapping four plastic retaining clips (Fig. 1).

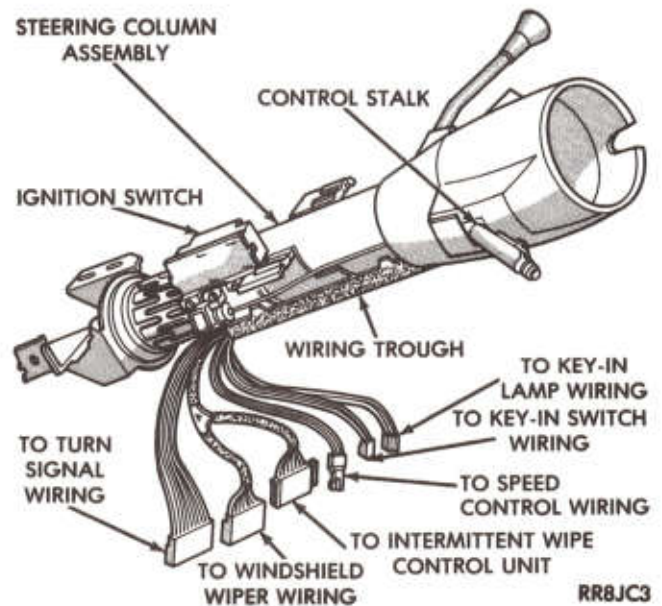


Fig. 1—Steering Column Connectors

- (4) Disconnect speed control switch electrical connector from instrument panel harness connector.
- (5) Remove wiper control knob from end of turn signal lever.
- (6) Remove silencer from lever.
- (7) Remove two screws attaching speed control switch to column.
- (8) On tilt columns remove steering wheel.
- (9) On tilt columns attach a flexible guide wire to lower end of speed control switch harness.

(10) On standard columns, remove upper steering column lock housing cover which is retained by two screws.

(11) Gently remove switch and harness from column taking care to avoid damaging wires while pulling them up through column.

On tilt columns pull wires through lock housing between lock-plate and side of housing. Then disconnect guide wire from harness.

Installation

(1) On standard columns, insert harness and connector through turn signal lever opening in column and pull down and out lower end.

(2) On tilt columns, insert harness connector through turn signal lever opening in column and pull upward through upper housing. Attach guide wire to switch wiring harness and gently pull downward through column opening, between lockplate and side of housing, taking care to avoid damaging wires.

(3) Remove all slack from wires.

(4) On tilt columns, remove guide wire.

(5) Install wiring trough with plastic clips.

(6) Connect speed control switch electrical connector to instrument panel harness connector.

(7) Secure speed control switch to column with two screws.

(8) Position silencer on lever.

(9) Push wiper control knob in place on end of lever.

(10) On tilt columns replace steering wheel.

(11) On standard columns install upper steering column lock housing cover.

(12) Install lower steering column cover.

(13) Connect negative battery cable and test operation of speed control.

SERVO THROTTLE CABLE ASSEMBLY

Removal

(1) Remove air cleaner.

(2) Disconnect cable at retaining clamp and at carburetor (throttle body), removing snap ring (retaining clip).

(3) Disconnect cable at servo and remove cable assembly.

Installation

(1) Locate cable through servo mounting bracket.

(2) Connect cable sleeve to servo stud, align holes, and install hairpin clip.

(3) Insert servo studs through holes in cable and holes in bracket, install nut-washers, and tighten to 80 in. lb. (9 N·m).

(4) Route cable from servo, through cable support bracket and clip, and install cable end on stud of carburetor (throttle body).

(5) Adjust cable as described under speed control cable adjustment.

(6) Replace air cleaner.

TURN SIGNALS AND HAZARD WARNING FLASHER

INDEX

	Page		Page
General Information	1	Turn Signal/Hazard Warning System	
Service Procedures	4	Diagnosis	2
Switch Continuity Chart	4	Turn Signal/Hazard Warning Flasher Location ...	3
Testing Procedures	3	Turn Signal/Hazard Warning Switch	4

GENERAL INFORMATION

Turn Signals

The turn signals are actuated with a lever on the left side of the steering column just below the steering wheel. When the driver wishes to signal his intentions to change direction of travel, he moves the lever upward to cause the right signals to flash and downward to cause the left signals to flash. (Fig. 1).

After completion of a turn the system is deactivated automatically. As the steering wheel returns to the straightahead position, a canceling cam in the turn signal switch (with standard column - rotated by steering wheel; with tilt column - rotated by column lock plate) comes in contact with one of two canceling fingers of the turn signal switch. The cam pushing on the switch canceling finger returns the switch to the OFF position.

If only momentary signaling such as indication of a lane change is desired, the switch is actuated to a left or right intermediate detent position. In this position the signal lamps flash as described above, but the switch returns to the OFF position as soon as the lever is released (Fig. 1).

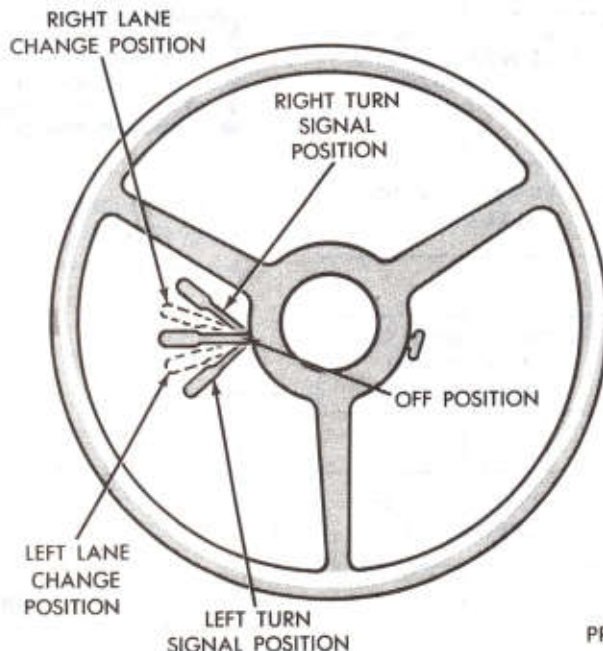
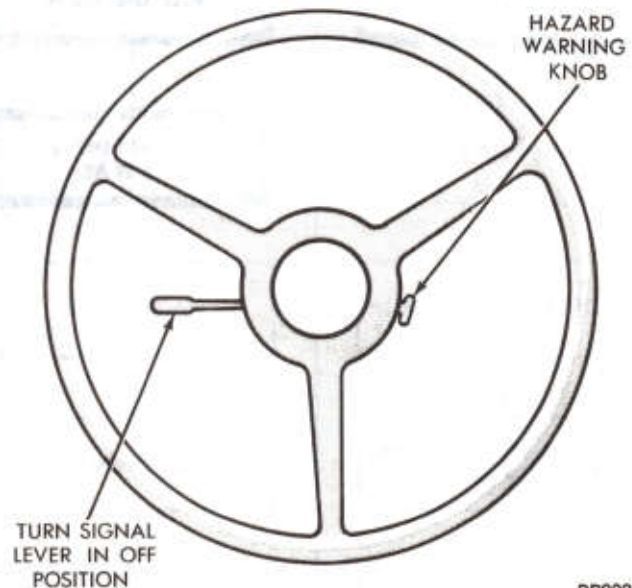


Fig. 1—Turn Signal Lever Positions

When the system is activated, one of two indicator lamps mounted in the instrument cluster flashes in unison with the turn signal lamps, indicating to the driver that the system is operating.



PR902 A

Fig. 2—Hazard Warning Knob

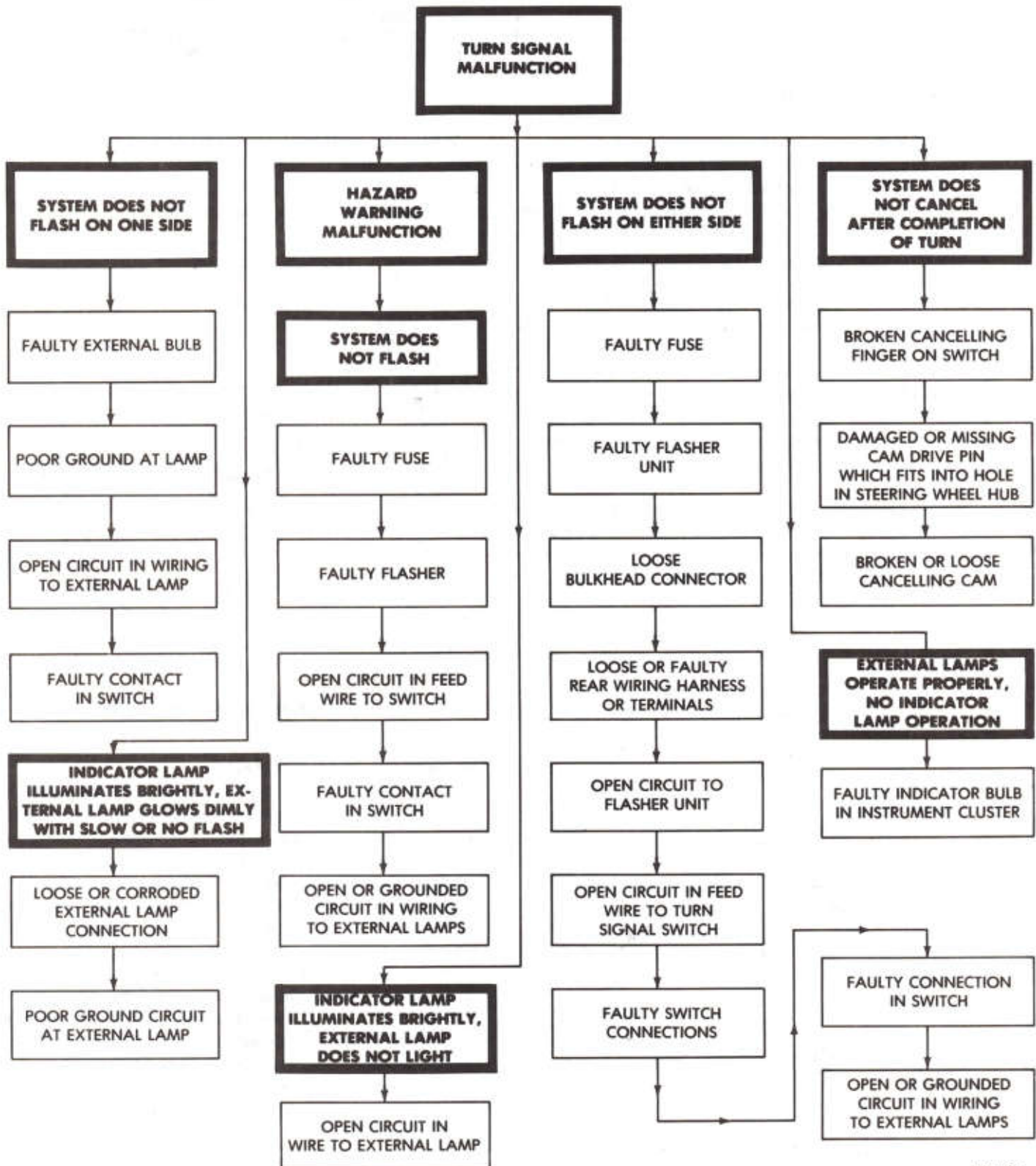
Hazard Warning System

The hazard warning system is actuated by a switch knob (Fig. 2) on the right side of the steering column just below the steering wheel. On standard columns the knob is pulled out (away from the column) to operate the hazard warning system, and on the Tilt column it is pushed in. When the switch is actuated all turn signal lamps and turn signal indicators flash simultaneously.

When the hazard warning switch is actuated, the turn signal switch should be in the OFF position to avoid a characteristic feed back through the accessory circuit which might cause intermittent operation of any accessories left with switches turned on.

When the hazard warning switch is actuated and the brakes applied, the hazard warning lamps will continue to flash.

TURN SIGNAL AND HAZARD WARNING SYSTEM DIAGNOSIS



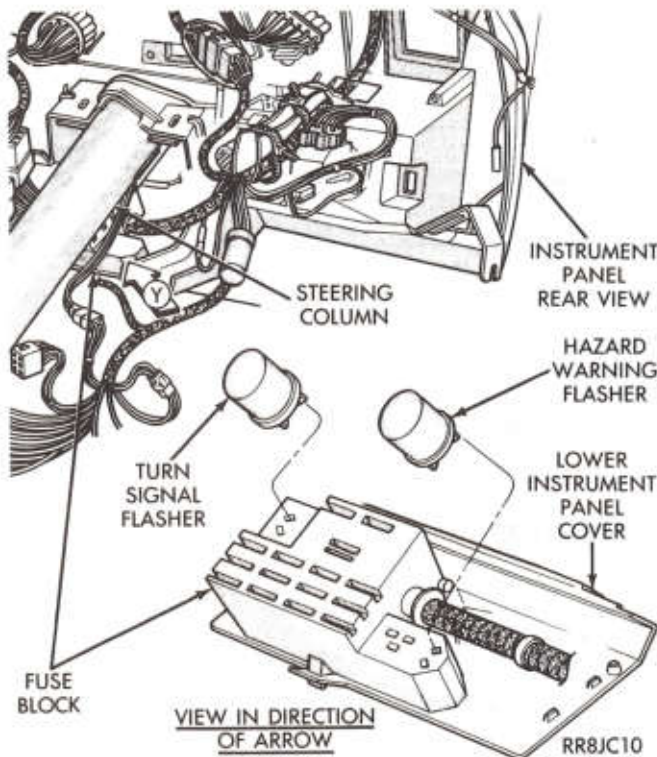


Fig. 3—Turn Signal and Hazard Warning Flashers

TESTING PROCEDURES

TURN SIGNAL AND HAZARD WARNING SWITCH TESTS

The turn signal switch and hazard warning switch operate the same lamps, and therefore, have much common wiring. Analyzing both systems when there is a fault can often lead to more rapid identification of the fault.

Since the stop lamp circuitry feeds through both the turn signal switch and the hazard warning switch, these switches should be given consideration when there is a failure in the stop lamp circuit.

To test the switch, first disconnect negative battery cable then the switch wires from the body wiring at the connector (Fig. 1).

Then, using a continuity tester or an ohmmeter, test for continuity (no resistance) between the terminals of the switch as shown in the following continuity chart. The identity of each terminal is shown in (Fig. 2).

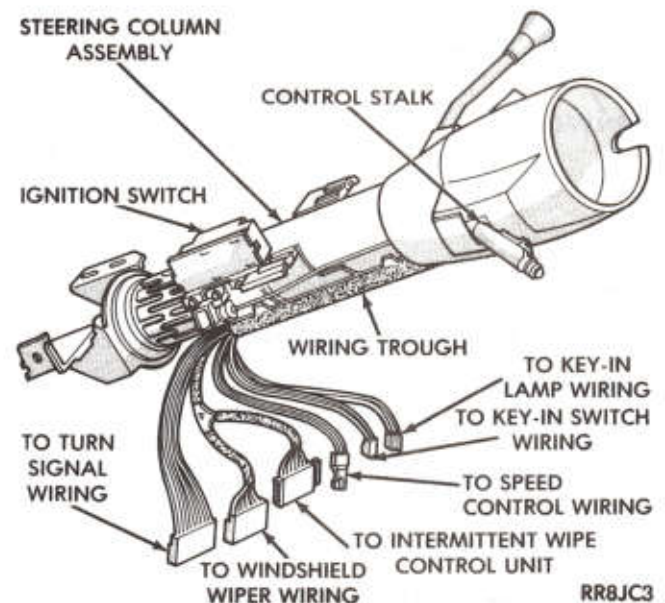
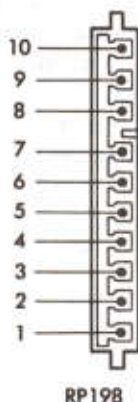


Fig. 1—Steering Column Wiring Connectors

WIRE CAVITY	WIRE COLOR	APPLICATION
10	WHITE	STOP LIGHT SWITCH
9	BROWN/RED	RIGHT REAR
8	DK GRN/RED	LEFT REAR
7	RED*	TURN SIGNAL FLASHER
6	PINK	HAZARD WARNING FLASHER
5	TAN	RIGHT FRONT
4	LIGHT GREEN	LEFT FRONT
3	BLACK/RED	HORN
2	BLACK	HORN GROUND
1		



SWITCH CONTINUITY CHART			
Turn Signal Switch			
Switch Position:	Left	Neutral	Right
Continuity Between:	7 and 4	10 and 9	7 and 5
Continuity Between:	7 and 8	10 and 8	7 and 9
Continuity Between:	10 and 9	—	10 and 8
Hazard Warning Switch			
Switch Position:	Off	On	
Continuity Between:	10 and 9	6 and 4	
Continuity Between:	10 and 8	6 and 5	
Continuity Between:	—	6 and 8	
Continuity Between:	—	6 and 9	

Fig. 2—Turn Signal Switch Connector

SERVICE PROCEDURES

TURN SIGNAL/HAZARD WARNING SWITCH

Removal

- (1) Disconnect battery negative cable.
- (2) Remove lower column bezel from instrument panel.

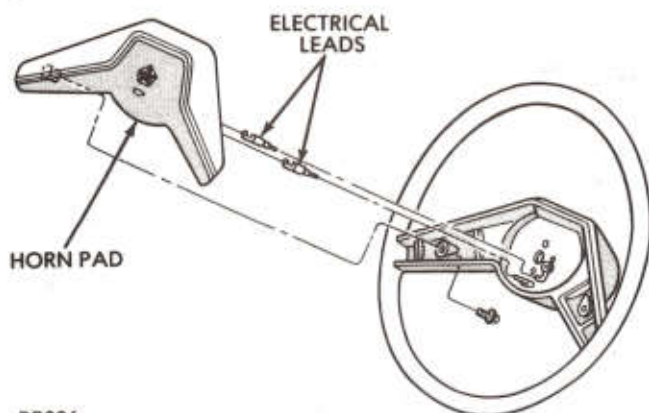


Fig. 1—Steering Wheel Type I

- (3) On Type I and Type II steering wheels (Figs. 1 and 2) remove horn pad and disconnect electrical leads from pad.

- (4) Remove steering wheel nut and remove steering wheel with puller C-3428B.

- (5) Disassemble steering column for switch removal.

(a) **Standard Column:** Remove screw holding wiper-washer switch to turn signal switch pivot. Leave the entire turn signal lever (control stalk) in its installed position.

Remove three screws attaching turn signal switch to upper bearing housing (Fig. 3).

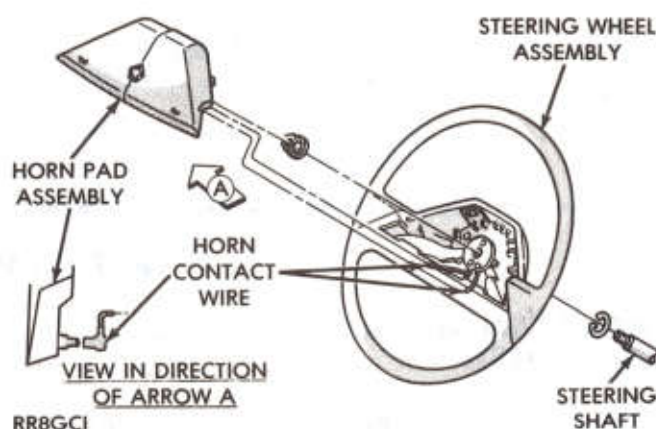


Fig. 2—Steering Wheel Type II

- (b) **Tilt Column:** Depress lock plate with Tool C-4156 and pry retaining ring out of groove with screwdriver (Fig. 4). **The full load of the upper bearing spring should not be relieved;** if it is, the retaining ring will turn too easily making removal more

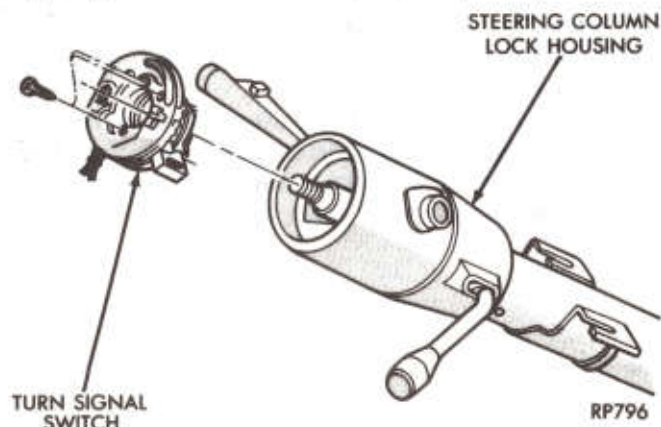


Fig. 3—Turn Signal Switch

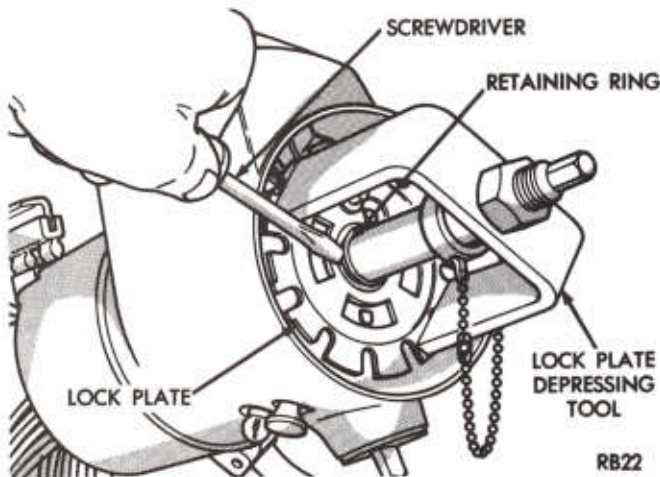


Fig. 4—Removing Lock Plate Retaining Ring Using Tool C-4156

difficult. Remove lock plate, and upper bearing spring.

Place turn signal switch in right turn position. Remove screw which attaches link between turn signal switch and wiper-washer switch pivot. Remove screw which attaches hazard warning switch knob (Fig. 5). Remove three screws attaching turn signal switch to steering column.

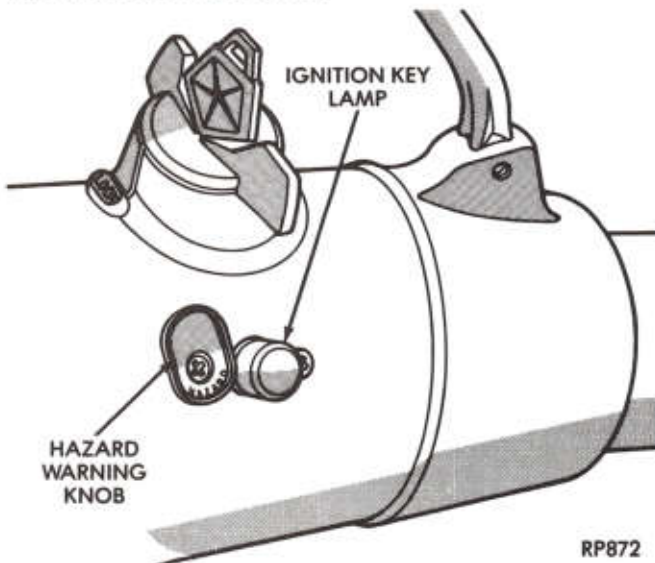


Fig. 5—Hazard Warning Switch Knob

(6) Wrap a piece of tape around the turn signal switch wiring and connector to prevent snagging when removing the switch.

(7) Remove turn signal and hazard warning switch assembly by gently pulling switch up from column while straightening and guiding wires up through column opening.

Installation

(1) On standard columns, lubricate turn signal switch pivot (entire 360° around depth of column hole through which it installs). Use a film of Lubriplate or a light lubricant equivalent.

(2) Tape wiring harness connector to wiring harness, then maneuver connector through opening in steering column, then carefully guide wires down through column.

(3) Assemble upper art of steering column.

(a) **Standard Column:** Position turn signal switch into place on upper bearing housing. Install three mounting screws and tighten securely. Position turn signal lever (control stalk) to turn signal switch pivot, then put screw through pivot and tighten securely. Be sure that dimmer switch rod is in control stalk pocket.

(b) **Tilt Column:** Position turn signal switch in upper column housing. Place switch in right turn position. Install three mounting screws and tighten. Place link in position between turn signal switch and wiper-washer switch pivot, and secure with screw. Install upper bearing spring and lock plate. Using Tool C-4156 compress lock plate and install a **new retaining ring**. Install hazard warning knob with screw.

(4) Connect wiring harness connector and install wiring trough to column with plastic buttons.

(5) For vehicles with floor shift, install lower steering column cover.

(6) Position steering wheel master serration over missing tooth on steering shaft.

(7) Install horn switch and steering wheel nut. Torque steering wheel nut to 61 N·m (45 ft. lbs).

(8) Place gearshift lever in Park position, connect negative battery cable, and test operation of turn signal, hazard warning, horn, and dimmer switch.

WINDSHIELD WIPER AND WASHER SYSTEMS

CONTENTS

	Page		Page
GENERAL INFORMATION	1	WINDSHIELD WASHERS	12
INTERMITTENT WINDSHIELD		WINDSHIELD WIPER SYSTEM	
WIPER MOTOR AND SWITCH		SERVICE PROCEDURES	9
TESTING PROCEDURES	5	WINDSHIELD WIPER DIAGNOSIS	2
TWO SPEED WINDSHIELD WIPER MOTOR			
AND SWITCH TESTING PROCEDURES	1		

GENERAL INFORMATION

The windshield wipers can be operated with the windshield wiper switch only when the ignition switch is in the ACCESSORY or IGNITION position. A fuse located in the fuse block protects the circuitry of the wiper system and the vehicle.

The same motor is used for standard and intermittent wipe systems.

The wiper motor has permanent magnet fields. The speeds are determined by current flow to the appro-

priate set of brushes.

The intermittent wipe system, in addition to low and high speed, has a delay mode. The delay mode has a range of 2 to 15 seconds. This is accomplished by a variable resistor in the wiper switch and is controlled electrically by a relay.

The wiper system completes the wipe cycle when the switch is turned OFF. The blades park in the lowest portion of the wipe pattern.

TWO SPEED WINDSHIELD WIPER MOTOR AND SWITCH

TESTING PROCEDURES

INDEX

	Page		Page
Standard Two Speed Wiper Motor System Test ...	1	Wiper Switch Continuity Chart	4
Switch Test	4		

STANDARD TWO-SPEED WIPER MOTOR SYSTEM TEST

The following is a list of general wiper motor system problems, the tests that are to be performed to locate the faulty part, and the corrective action to be taken. The same motor is used for standard and optional systems. If the malfunction involves only the Delay mode, switch, or wiring, refer to the Intermittent Windshield Wiper Motor and Switch Service Procedures.

Condition

Motor will not run in any switch position.

Procedure

- (1) Check for a blown fuse in the fuse block.
 - (a) If fuse is good, proceed to step No. 2.
 - (b) If fuse is defective, replace and check motor operation in all switch positions.
 - (c) If motor is still inoperative and the fuse does not blow, proceed to step No. 2.
 - (d) If replacement fuse blows, proceed to step No. 5.

- (2) Place switch in low speed position.
- (3) Listen to motor. If you cannot hear it running, proceed to Step No. 4. If you hear it running, check motor output shaft. If output shaft is not turning, replace motor assembly. If it is turning, drive link to

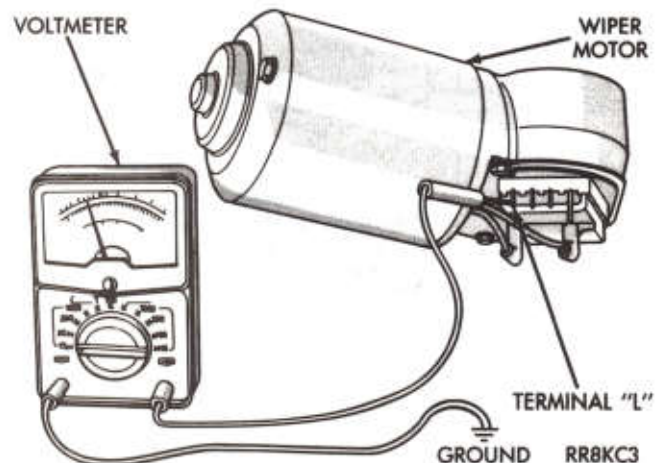
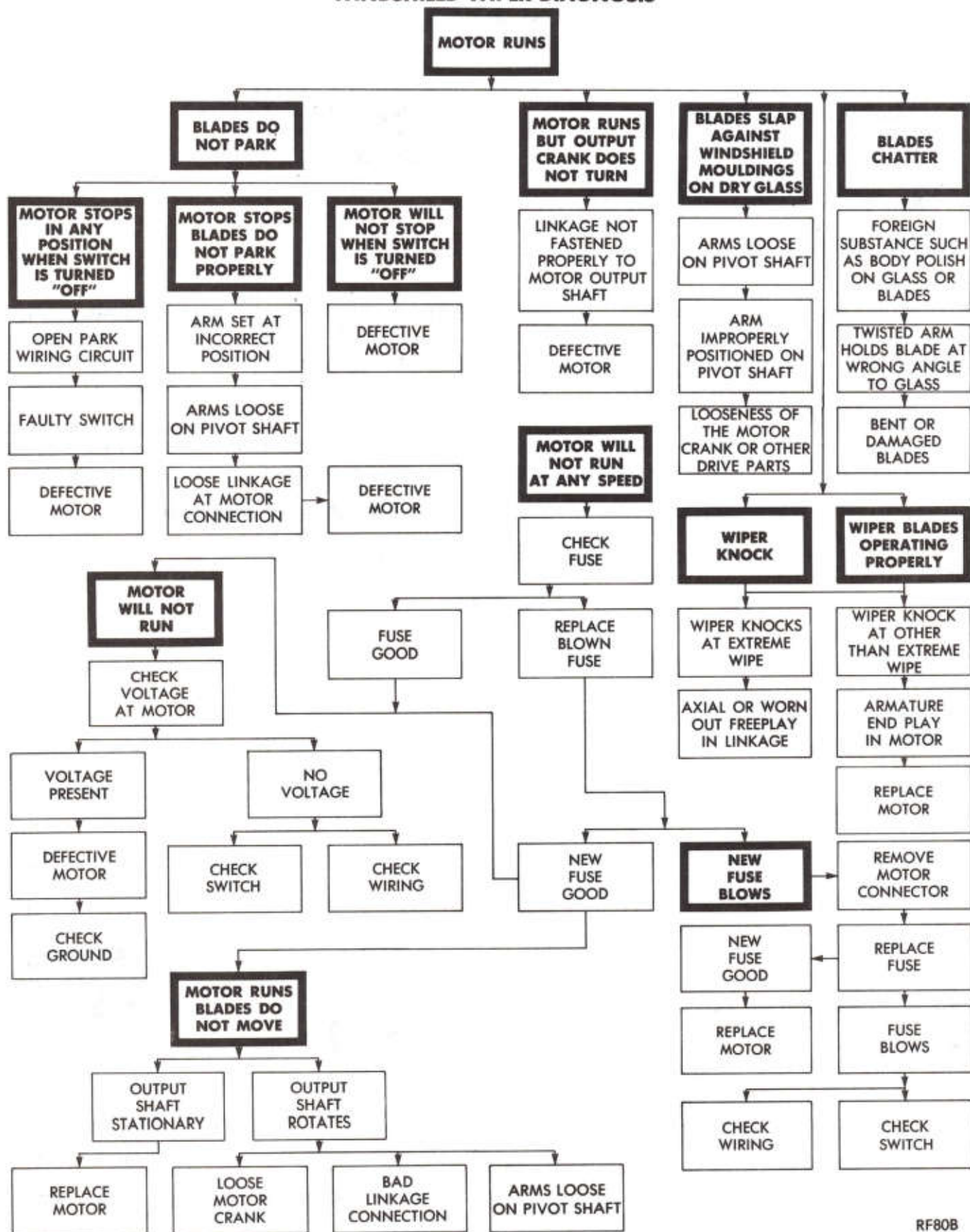


Fig. 1—Voltmeter Between Terminal "L" and Ground

WINDSHIELD WIPER DIAGNOSIS



output shaft or linkage is not properly connected. Replace worn parts and/or properly connect drive link to the motor output shaft.

(4) Connect a voltmeter between motor terminal "L" and ground strap (Fig. 1). If there is no voltage or very little voltage (less than one volt) present, move negative test lead from the ground strap to negative battery terminal.

(a) If an increase in voltage is noticed, the problem is a bad ground circuit. Make sure that motor mounting is free of paint and that nuts or bolts are tight.

(b) If there is still no indication of voltage, the problem is an open circuit in the wiring harness or wiper switch.

(c) If no noticeable increase (greater than 3 volts) in voltage is observed, the problem is a faulty motor assembly.

(5) Disconnect motor wiring connector and replace fuse.

(a) If fuse does not blow, motor is defective.

(b) If fuse blows, switch or wiring is at fault.

Condition

Motor runs slowly at all speeds.

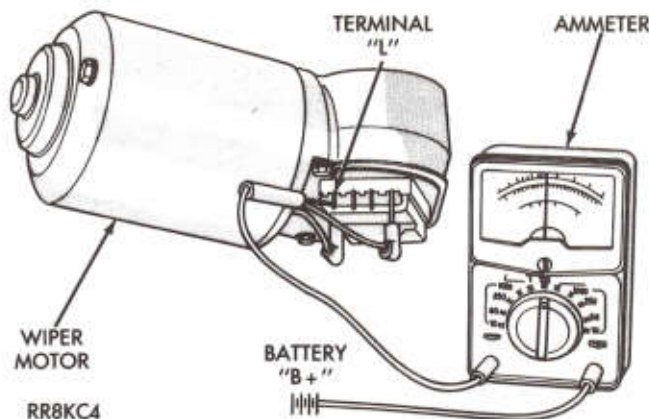


Fig. 2—Ammeter Between Terminal "L" and Battery

Procedure

(1) Disconnect wiring harness connector at motor. Remove wiper arms and blades. Connect an ammeter between battery and terminal "L" on motor (Fig. 2).

(a) If motor runs and average ammeter reading is more than 6 amps, proceed to step 2.

(b) If motor runs and average ammeter reading is less than 6 amps, proceed to step 3.

(2) Check to see if wiper linkage or pivots are binding or caught. Disconnect drive link from motor.

(a) If motor now runs and draws less than 3 amps, repair linkage system.

(b) If motor continues to draw more than 3 amps, replace motor assembly.

(3) Check motor wiring harness for shorting between high and low speed wires as follows:

(a) Connect a voltmeter or test lamp to motor ground strap.

(b) Set wiper switch to LOW position.

(c) Connect other lead of voltmeter (test lamp) to terminal "H" of the wiring harness.

(d) If voltage is present, there is a short in the wiring or wiper switch. If no voltage is present proceed to step (e).

(e) Set wiper switch to HIGH position.

(f) Move voltmeter (test lamp) lead from terminal "H" to terminal "L" of the wiring harness.

(g) If voltage is present, there is a short in the wiring or wiper switch.

Condition

Motor will run at high speed, but at low speed.

Motor will run a low speed, but not at high speed.

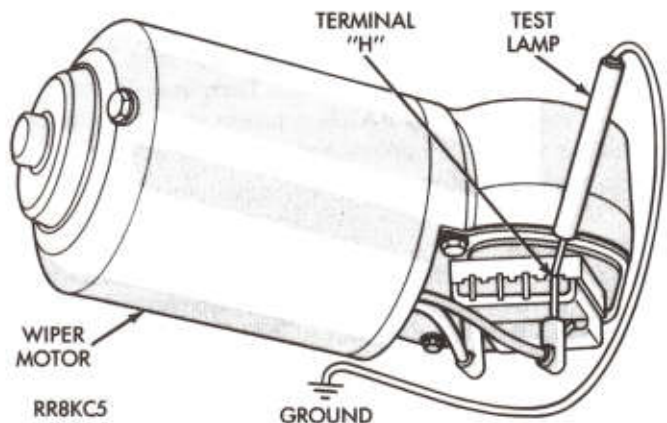


Fig. 3—Test Lamp Between Terminal "H" and Ground

Procedure

(1) If motor will not run on high speed, put switch in HIGH position and connect a test lamp between motor Terminal "H" and ground (See Fig. 3).

If motor will not run on low speed, put switch in LOW position and connect a test lamp between motor Terminal "L" and ground.

(2) If test lamp does not light at motor terminal, there is an open in wiring or switch. If test lamp lights at motor terminal, replace motor assembly.

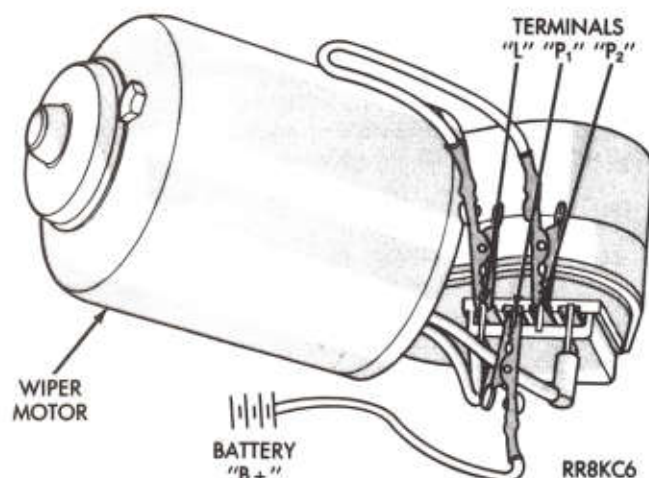


Fig. 4—One Jumper Wire Between Terminal "P₂" and "L" One Jumper Wire Between Terminal "P₁" and "B+"

Condition

Motor will keep running with switch in OFF position.

Procedure

Remove wiring harness. Connect jumper from Terminal P₂ to Terminal L of wiper motor (Fig. 4).

Connect second jumper from Terminal P₁ to battery. If motor runs to PARK position and stops, wiper switch is faulty. If motor keeps running and does not park, replace motor assembly.

Condition

Motor will stop wherever it is, when column switch is put in OFF position. (Wipers do not continue running to PARK position.)

Procedure

(1) Remove motor wiring connector and clean terminals. Reconnect connector and test motor. If problem persists, proceed to Step No. 2.

(2) Put wiper switch to OFF position. Disconnect motor wiring connector. Connect a voltmeter or test lamp to the motor ground strap. Connect the other lead to terminal "P₁" of wiring connector.

(a) If voltage is not present, check for an open circuit in the wiring harness or wiper control switch.

(b) If voltage is present, proceed to step (3).

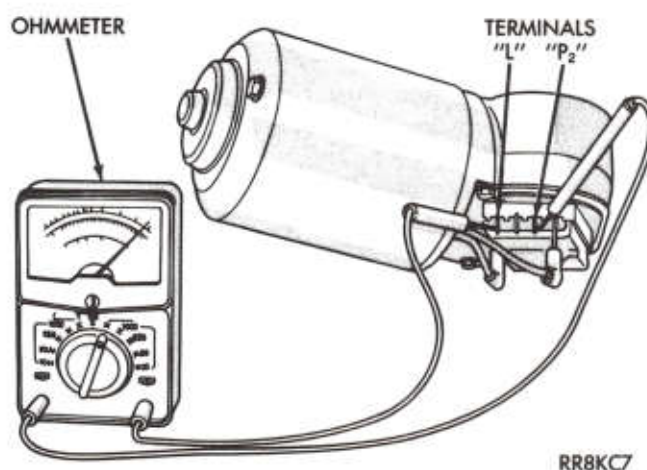


Fig. 5—Ohmmeter Between Terminal "L" and "P₂"

(3) Connect an ohmmeter or continuity tester between terminals "L" and "P₂" (Fig. 5).

(a) If there is continuity between these terminals, the problem is a defective motor.

(b) If there is not continuity, the problem is an open circuit in the wiper control switch or wiring harness.

SWITCH TEST

To test the switch, first disconnect the switch wires from the body wiring at the connector. Then, using a continuity tester or an ohmmeter, test for continuity (no resistance) between the terminals of the switch as shown in the following continuity chart. The identity of each terminal is shown in (Fig. 6).

For test purposes, the first (or clockwise) position is the OFF position, with LOW being the next detent position and HIGH being the last (counterclockwise) detent position. In any wiper mode, if the knob is pushed all the way in, the washer circuit will be completed.

WIPER SWITCH CONTINUITY CHART Two Speed Switch		
Off	Low	High
B + to P ₁	B + to P ₁	B + to P ₁
L to P ₂	B + to L	B + to H
H—Open	P ₂ —Open	P ₂ —Open
	H—Open	L—Open
B + to W	B + to W	B + to W
(In Wash)	(In Wash)	(In Wash)

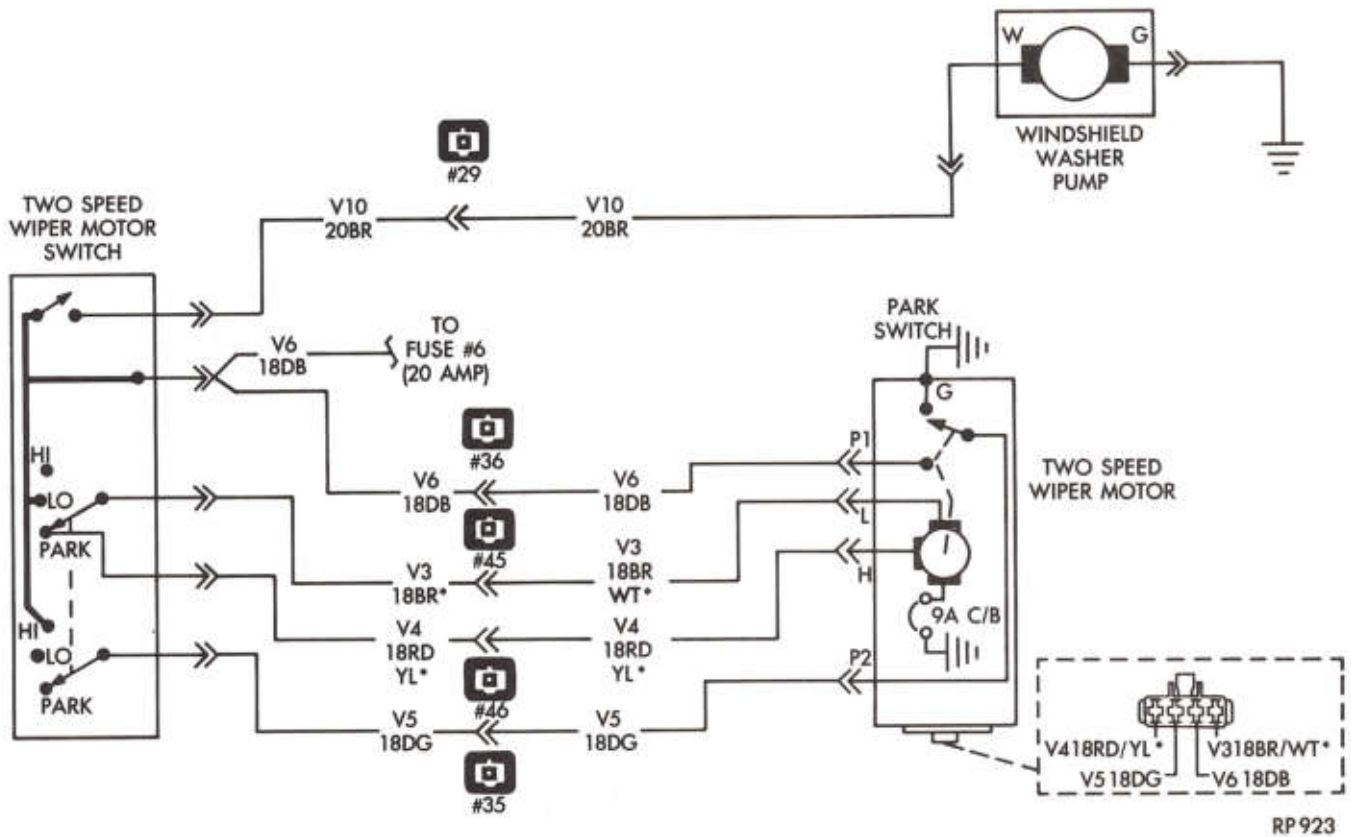


Fig. 6—Two Speed Wiper Motor Wiring Schematic

INTERMITTENT WINDSHIELD WIPER MOTOR AND SWITCH TESTING PROCEDURES

INDEX

	Page		Page
Intermittent Windshield Wiper Motor		Intermittent Wipe Switch Continuity Chart	8
System Test	5	Intermittent Wipe Switch Test	8
Intermittent Wipe Module Location	8		

INTERMITTENT WINDSHIELD WIPER MOTOR SYSTEM TEST

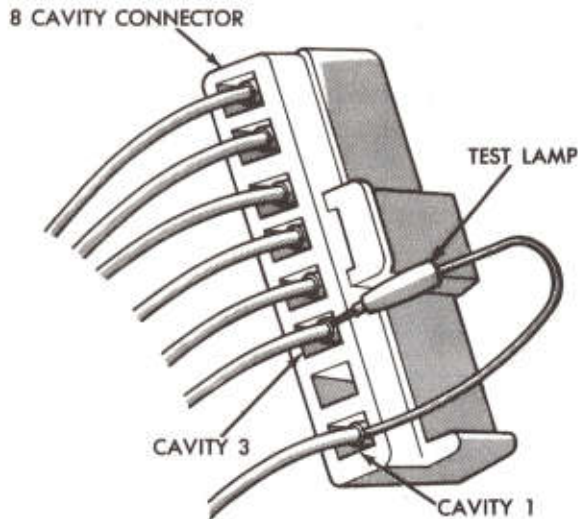
Since the intermittent wipe and standard two-speed motors are identical, refer to previous sections for diagnosis of system programs which do not involve the DELAY function. If problem occurs only in the DELAY mode, the following tests are to be performed. These tests involve disconnecting the intermittent wipe control unit which can be found on a bracket located behind the lower steering column cover.

Condition

Wipers do not stop (continue running without delay) when the switch is in DELAY position.

Verify that motor will park when the column switch is put in the PARK or OFF position.

- (1) Disconnect 8 cavity connector from intermittent wipe control unit and inspect contacts for damage.
- (2) Place switch in LOW position.

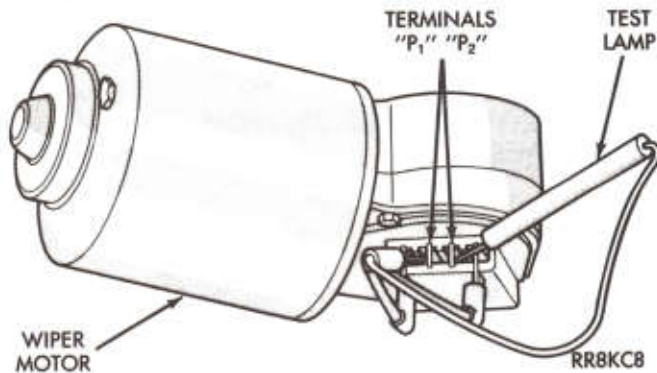


RY275

Fig. 1—Test Lamp Between Cavities 1 and 3

(3) Connect test lamp between cavities 1 and 3 of connector (Fig. 1). Once every cycle the lamp should light.

(4) If there is periodic flashing the control unit is faulty and should be replaced.


Fig. 2—Test Lamp Between Terminal "P₁" and "P₂"

(5) If not, check for periodic flashing between wiper motor wiring harness terminals, P₁ and P₂ (Fig. 2).

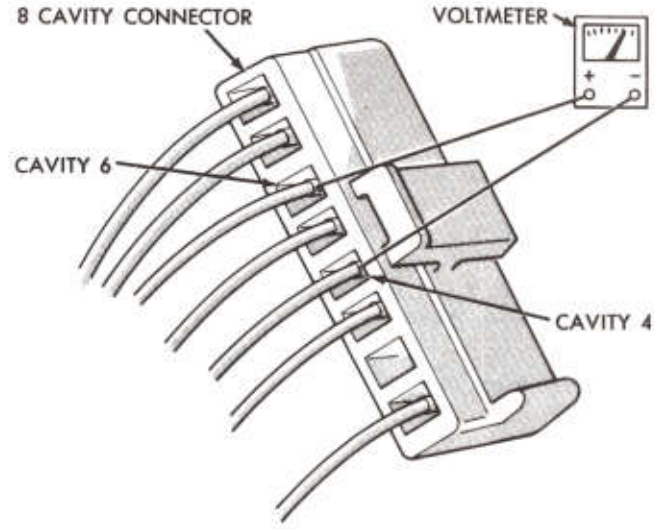
(6) If periodic flashing is at the motor, check the wiring to intermittent wipe control module.

Condition

Wipers do not come on when the switch is in DELAY position.

Procedure

(1) Disconnect connector for intermittent wipe control unit.



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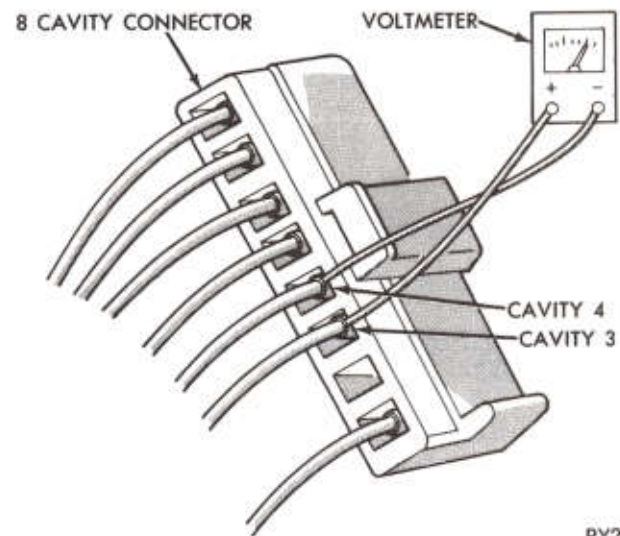
Fig. 3—Voltmeter Connected to Cavities 4 and 6

(2) Place switch in maximum DELAY (dwell) position.

(3) Connect voltmeter between cavity 4 and cavity 6 (Fig. 3).

(4) If voltmeter reads zero check switch and wiring.

(5) If voltmeter reads 10 to 15 volts, continue as follows:



RY277

Fig. 4—Voltmeter Connected to Cavities 3 and 4

(6) Place column switch in LOW position and connect voltmeter between cavity 3 (+) and cavity 4 (−) (Fig. 4). If voltmeter reads 10 to 15 volts, replace control unit. If voltmeter reads zero, checking wiring.

Condition

Wipers immediately give first wipe but do not operate in intermittent mode when switch is turned on.

Procedure

(1) Disconnect connector from intermittent wipe control unit. Inspect connector contacts for bent or deformed contacts.

(2) Place switch in maximum DELAY (dwell) position.

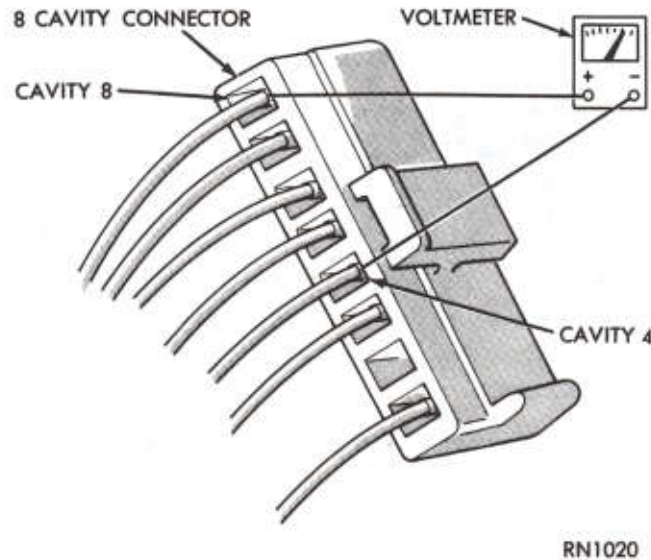


Fig. 5—Voltmeter Connected to Cavities 4 and 8

(3) Connect voltmeter between cavity 4 and 8 (Fig. 5).

(4) If voltmeter reads zero, check switch and wiring.

(5) If voltmeter reads 10 to 15 volts, the control unit is faulty and should be replaced.

Condition

Excessive delay (more than 30 seconds) or inadequate variation in delay.

Procedure

Variations in delay should be as follows:

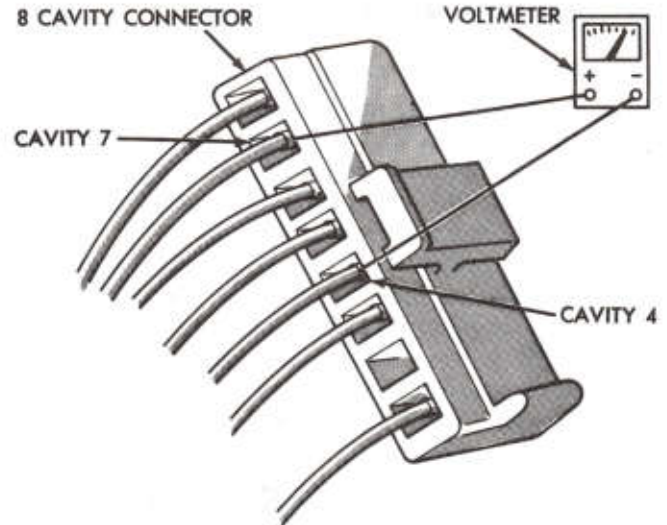
(1) Minimum delay (delay control to extreme counterclockwise position before first detent) one half to two seconds.

(2) Maximum delay (delay control to extreme clockwise position before off detent) ten to thirty seconds.

(3) If there is excessive delay or no variations in delay proceed to intermittent wipe switch test.

Condition

Wipers do not run continually when wash control is operated during delay mode.



RN1021

Fig. 6—Voltmeter Connected to Cavities 4 and 7

Procedure

(1) Disconnect connector from intermittent wipe control unit.

(2) Connect voltmeter between cavity 4 and 7 (Fig. 6).

(3) Depress wash switch.

(4) If voltage reads zero, check switch and wiring.

(5) If voltage is 10 to 15 volts, the control unit is faulty and should be replaced.

Condition

In DELAY mode wipers run continually when wash is operated but do not provide an extra wipe when the wash control is released.

Procedure

Replace the control unit.

Condition

Wipers start erratically during DELAY mode.

Procedure

(1) Verify that the ground connection at the instrument panel is making good connection (free from paint) and is tight.

(2) Verify that the motor ground strap is making a good contact and that the motor mounting bolts are tight.

(3) Verify that the wiring ground connections for the intermittent wipe control unit and the wiper switch are tight.

(4) If condition is not corrected, replace control unit.

INTERMITTENT WIPE SWITCH TEST

To test the switch, first disconnect the switch wires from the body wiring at the connector. Then, using a continuity tester or an ohmmeter, test for continuity (no resistance) between the terminals of the switch as shown in the following continuity chart. The identity of each terminal is shown in (Fig. 8).

For test purposes, the first (or clockwise) position is the OFF position, next is the slide for the DELAY wipe, with counterclockwise rotation, reducing the delay. LOW is the next detent position and HIGH is the first counterclockwise detent position.

In any wiper mode, if the knob is pushed all the way in, the washer circuit will be completed.

INTERMITTENT WIPE SWITCH CONTINUITY CHART	
SWITCH POSITION	CONTINUITY BETWEEN
OFF	L and P ₂
DELAY	P ₁ and I ₁ R and I ₁ * I ₂ and G
LOW	P ₁ and L
HIGH	P ₁ and H

* Resistance at maximum delay position should be between 270,000 ohms and 330,000 ohms.
* Resistance at minimum delay position should be zero with ohmmeter set on the high ohm scale.

INTERMITTENT WIPE MODULE LOCATION

The intermittent wipe module is located to the right of the steering column on the back side of the instrument panel (Fig. 7).

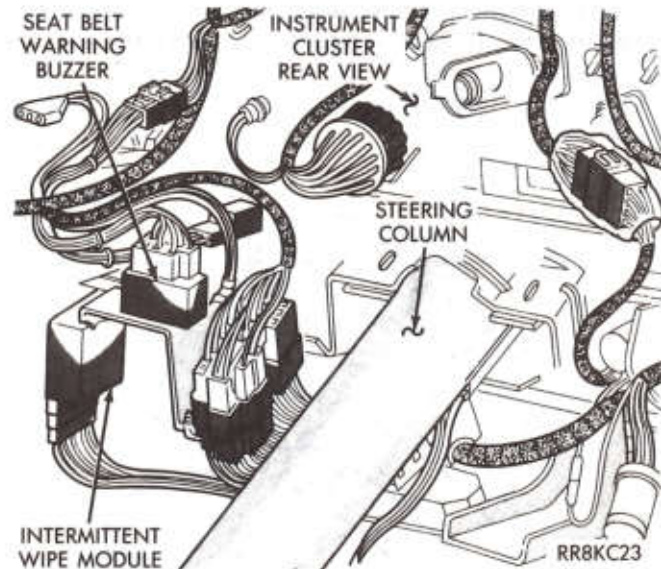


Fig. 7—Intermittent Wipe Module Location

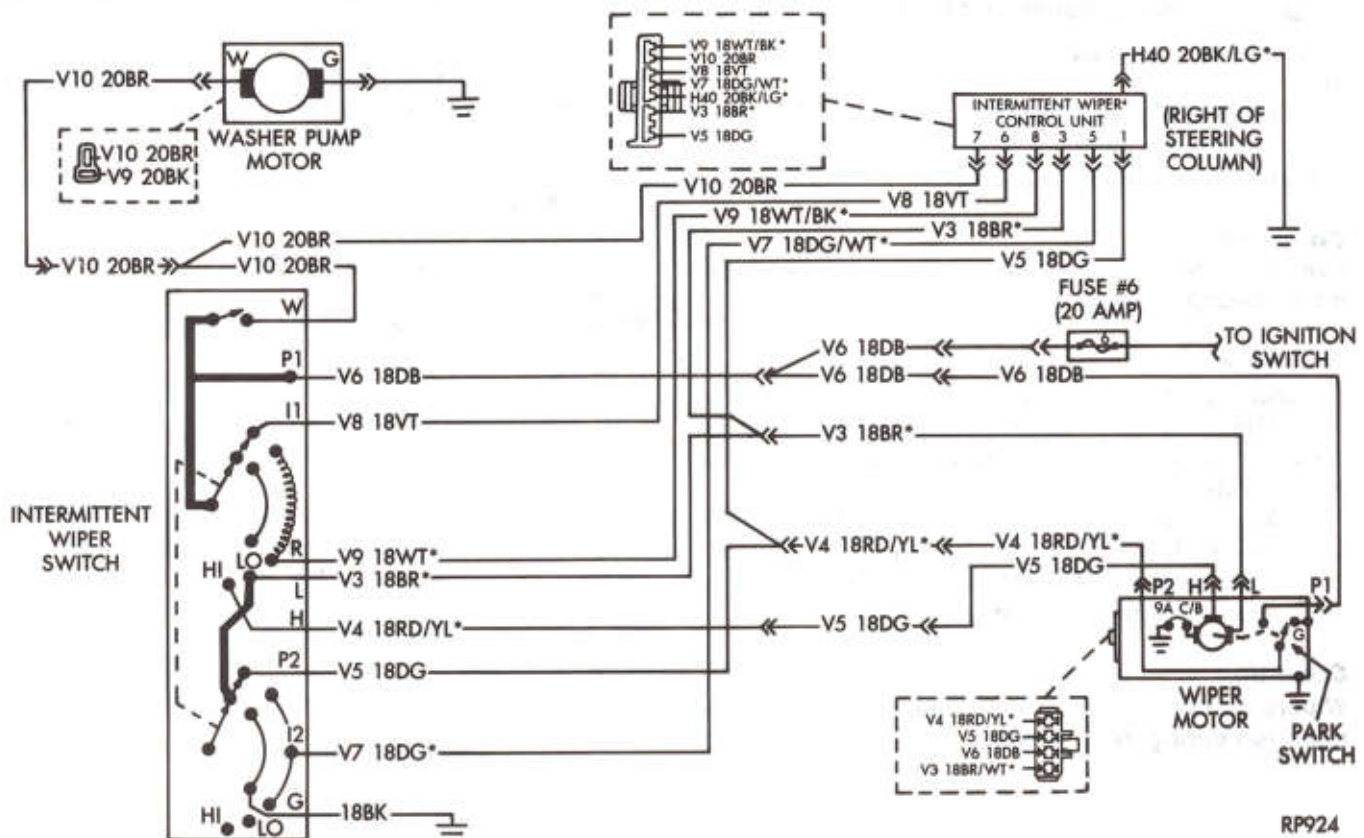


Fig. 8—Intermittent Wipe Wiring Schematic

WINDSHIELD WIPER SYSTEM SERVICE PROCEDURES

INDEX

	Page		Page
Linkage Replacement	10	Wiper Blades	9
Wiper Arm Adjustment	10	Wiper Blade Element Change	9
Wiper Arm Replacement	10	Wiper Motor Replacement	10

WIPER BLADES

Wiper blades exposed to the weather for a long period of time tend to lose their wiping effectiveness. Periodic cleaning of the wiper blade is suggested to remove the accumulation of salt and road film. The wiper blades, arms and windshield should be cleaned with a sponge or cloth and a mild detergent or nonabrasive cleaner. If the blades continue to streak or smear, they should be replaced.

WIPER BLADE ELEMENT CHANGE

There are two types of wiper blade assemblies (depending on truck line). The assemblies are identified as "Type A" (Fig. 1) and "Type B" (Figs. 2 and 3).

(1) Turn wiper switch ON, position blades to a convenient location by turning ignition switch ON and OFF.

(2) Lift wiper arm to raise blade off of glass.

(3) Remove blade assembly from arm and wiping element from blade, depending on type, as follows:

Type A—To remove blade assembly from arm, insert a small screwdriver blade into release slot of wiper arm and pry slightly upward (Fig. 1).

To remove wiping element from the blade assembly pinch lock on end blade assembly and withdraw wiping element (blade) out of end bridge claws (Fig.1).

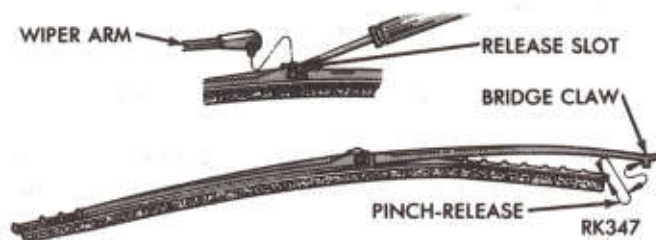


Fig. 1—Removing Blade and Wiping Element from Blade Assembly Type "A"

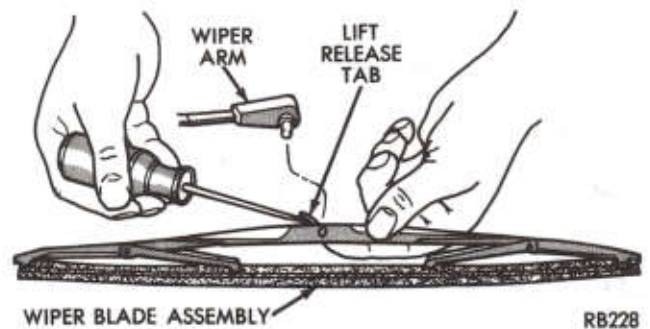


Fig. 2—Removing Blade from Arm Type "B"

Type B—To remove blade, lift up on wire spring clip and pull blade from arm (Fig. 2).

To remove the wiping element, position the blade assembly into a slight reverse bow and slide element out of end bridge claws. (Fig. 3).

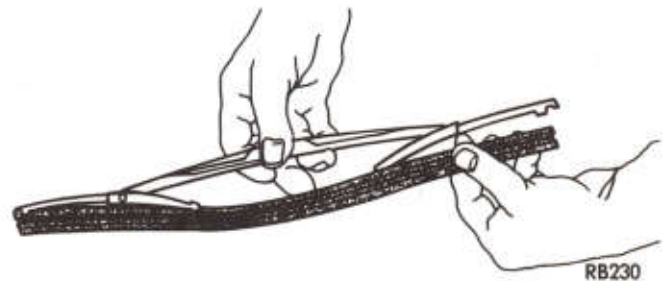


Fig. 3—Removing Wiping Element from Blade Assembly Type "B"

(4) After reinstallation of new wiping element, check each release point for positive positions and locking.

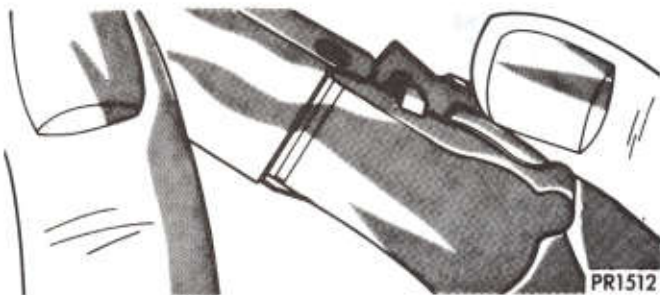


Fig. 4—Removing Wiper Arm

WIPER ARM REPLACEMENT

Removal

(1) Lift the arm to permit the latch (Fig. 4) to be pulled out to the holding position and remove the arm from the pivot using a rocking motion.

CAUTION: The use of a screwdriver or other prying tool to remove an arm may distort it in a manner that will allow it to come off the pivot shaft in the future, regardless of how carefully it is installed.

Installation

For proper installation of wiper arm refer to "Adjustment Procedures".

Adjustment Procedure

With wiper motor in PARK position, mount arms on pivot shafts, choosing a serration engagement which locates blades so that distance between tip of blade and lower windshield weather strip is as shown in Fig. 5.

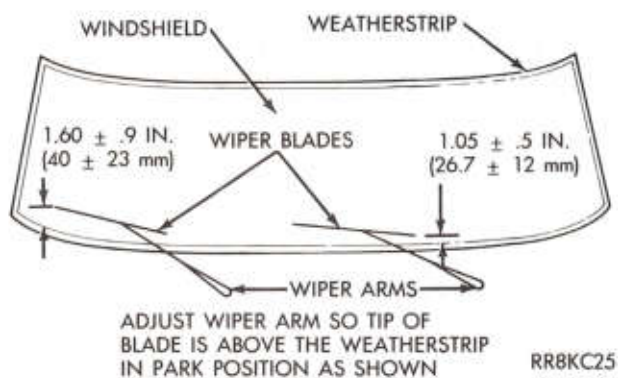


Fig. 5—Adjusting Wiper Arms

WIPER MOTOR REPLACEMENT

Removal

- (1) Disconnect negative battery cable at negative post.
- (2) Disconnect wires from wiper motor.
- (3) Remove motor mounting screws.
- (4) Lower motor down far enough to gain access to crank arm to drive link retainer bushing.
- (5) Remove crank arm from drive link by prying

retainer bushing from crank arm pin with a suitable size screwdriver.

- (6) Remove motor.
- (7) Remove nut attaching crank arm to motor drive shaft.
- (8) Remove crank arm.

Installation

- (1) Position crank arm on motor drive shaft, making sure slot is indexed properly, install mounting nut and tighten to 95 in. lbs. (11 N·m) torque.
- (2) Install crank arm pin in drive link retainer bushing by snapping together with channel lock pliers.
- (3) Position motor into place, install mounting screws, and tighten to 55 in. lbs. (6 N·m) torque.
- (4) Connect wires to wiper motor.
- (5) Connect battery cable.

LINKAGE REPLACEMENT (Fig. 6)

Crank Arm

Removal

- (1) Remove wiper motor.
- (2) Remove nut attaching crank arm to motor drive shaft.
- (3) Remove crank arm.

Installation

- (1) Position crank arm on motor drive shaft, making sure slot is indexed properly, install mounting nut and tighten to 95 in. lbs. (11 N·m) torque.
- (2) Install wiper motor.

Drive Link Assembly Left Pivot Assembly

Removal

- (1) Remove wiper arms.
- (2) Remove screws attaching louvered cowl cover to firewall.
- (3) Remove cowl cover by pulling forward with a slight upward movement.
- (4) Reach through access hole and remove drive link from right pivot by prying retainer bushing from pivot pin with a suitable size screwdriver.
- (5) Remove crank arm from drive link by prying retainer bushing from crank arm pin with a suitable size screwdriver.
- (6) Remove left pivot mounting screws and let pivot hang loose.
- (7) Working through access holes remove drive links and left pivot as an assembly.
- (8) Remove drive link from left pivot by prying retainer bushing from pivot pin with a suitable size screwdriver.

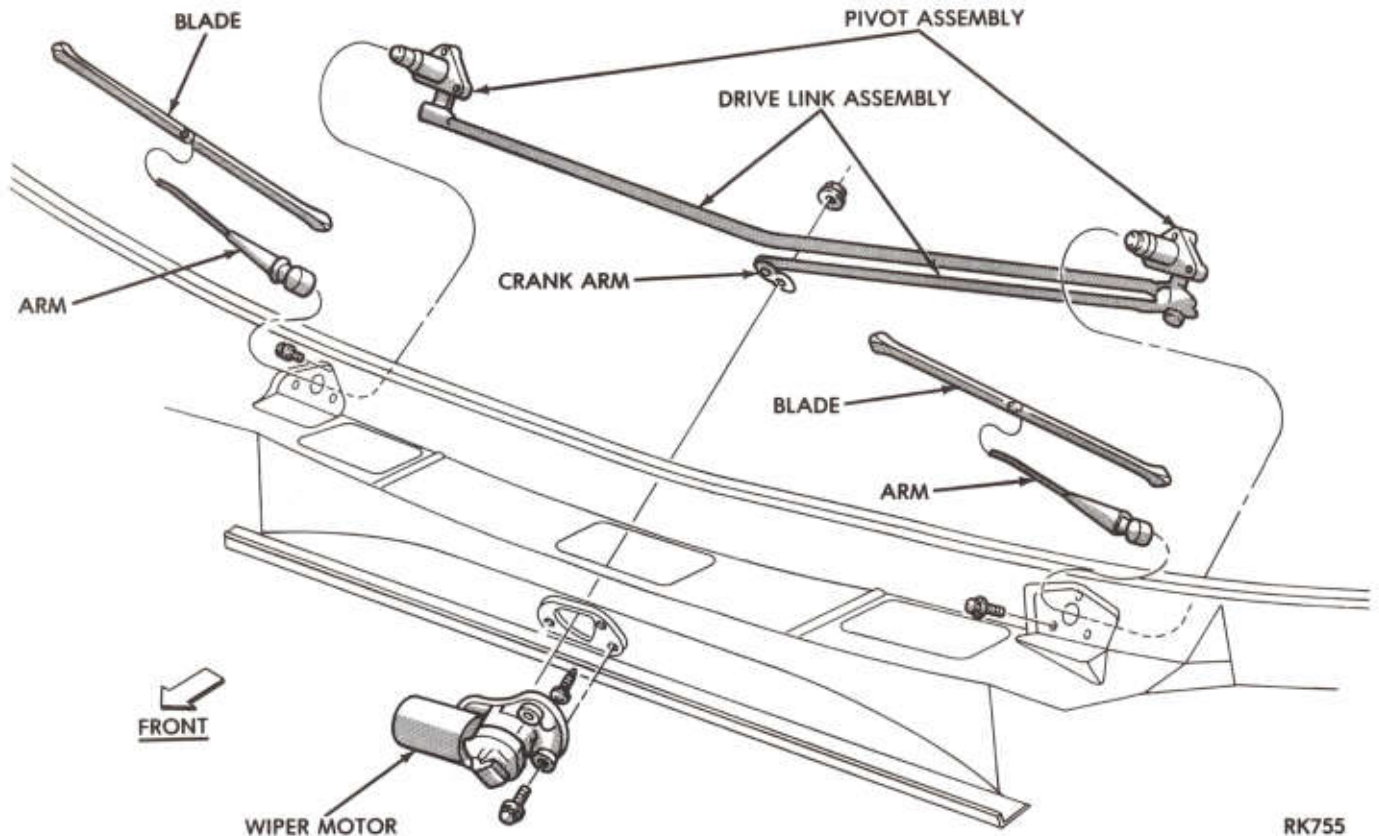


Fig. 6—Wiper Linkage

Installation

- (1) Install left pivot pin in drive link retainer bushing by snapping together with channel lock pliers.
- (2) Maneuver drive links and pivot assembly through access hole and position into place.
- (3) Position left pivot into place, install mounting screws and tighten to 95 in. lbs. (11 N·m) torque.
- (4) Install crank arm pin in drive link retainer bushing by snapping together with channel lock pliers.
- (5) Install right pivot pin in drive link retainer bushing by snapping together with channel lock pliers.
- (6) Position cowl cover into place, install mounting screws and tighten securely.
- (7) Install wiper arms, refer to wiper arm adjustment procedure.

Right Pivot Assembly**Removal**

- (1) Remove wiper arms.
- (2) Remove screws attaching louvered cowl cover to firewall.
- (3) Remove cowl cover by pulling forward with a slight upward movement.
- (4) Reach through access hole and remove drive link from right pivot by prying retainer bushing from pivot pin with a suitable size screwdriver.
- (5) Remove right pivot mounting screws.
- (6) Remove pivot through access hole.

Installation

- (1) Position pivot into place, install mounting screws, and tighten to 95 in. lbs. (11 N·m) torque.
- (2) Install right pivot pin in drive link retainer bushing by snapping together with channel lock pliers.
- (3) Position cowl cover into place, install mounting screws and tighten securely.
- (4) Install wiper arms.

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WINDSHIELD WASHERS

GENERAL INFORMATION

All models are equipped with electric operated windshield washer pumps.

The electric pump assembly is mounted directly to the reservoir. A permanently lubricated sealed motor is coupled to a rotor type pump. Fluid, gravity fed from the reservoir, is forced by the pump through rubber hoses to the nozzles which direct the streams to the windshield.

The pump and reservoir are serviced as separate assemblies.

These vehicles are equipped with special plastic washer nozzles (Fig. 1). Because they are inserted directly into the cowl panel, there is no adjustment required.

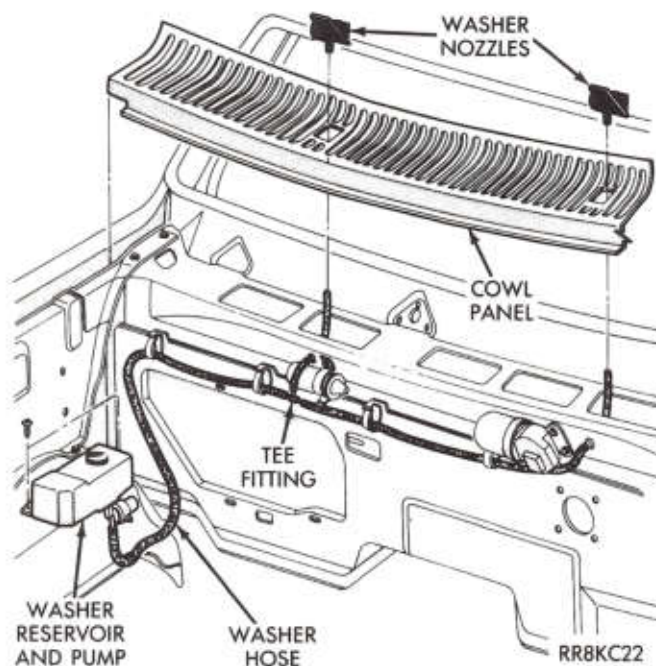
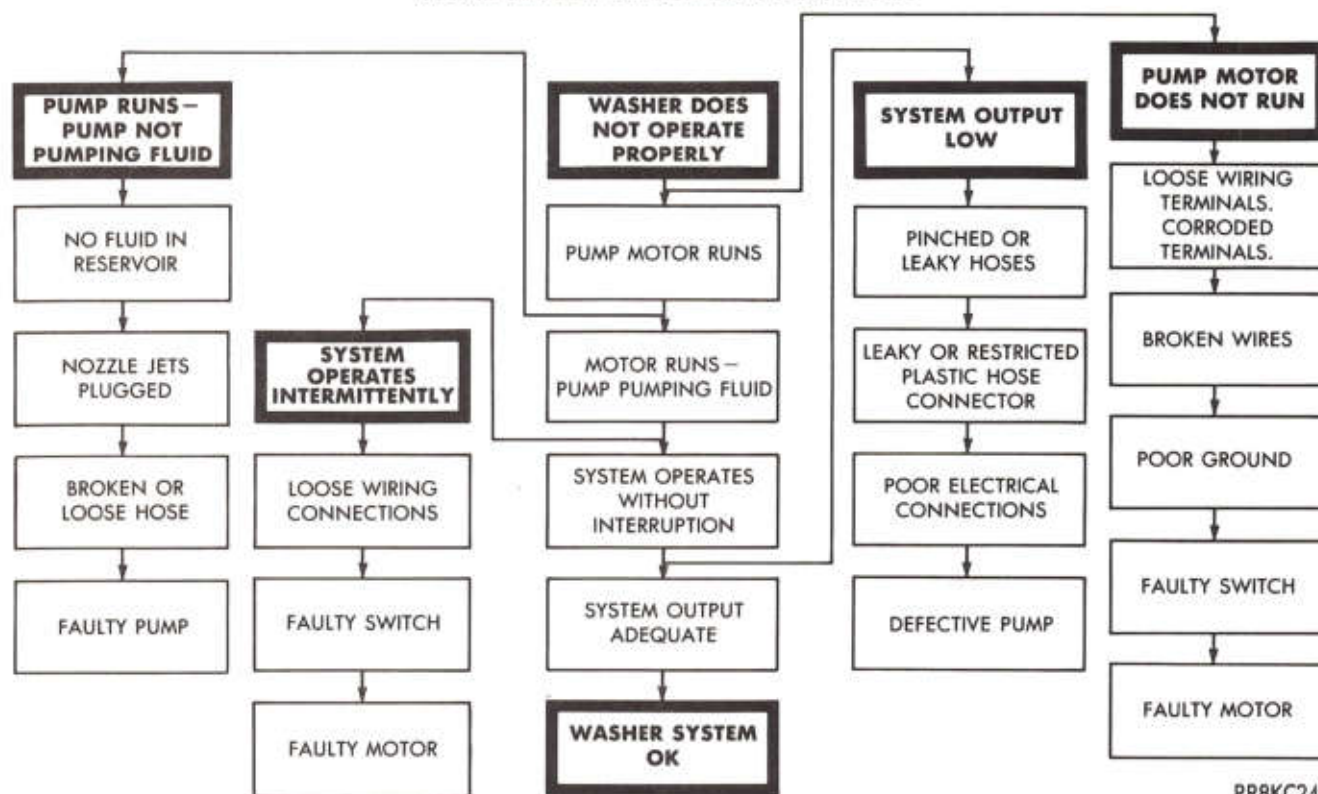


Fig. 1—Windshield Washer System

WINDSHIELD WASHER DIAGNOSIS



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WASHER PUMP (Fig. 2)**Removal**

- (1) Remove liquid from reservoir.
- (2) Remove reservoir mounting screws and remove reservoir and pump assembly.
- (3) Disconnect electrical lead and rubber hose from bottom of pump.
- (4) Using an extension and deep well socket, reach through reservoir filler neck, and remove pump mounting nut and plastic washer.
- (5) Remove pump from bottom of reservoir.
- (6) Remove rubber grommet from reservoir and throw away.

Installation

- (1) Install new rubber grommet on reservoir.
- (2) Position pump into place, install plastic washer,

mounting nut, and tighten to 25 in. lbs. (3 N·m).

(3) Connect electrical lead and rubber hose to pump.

(4) Position reservoir into place and install mounting screws.

(5) Fill reservoir.

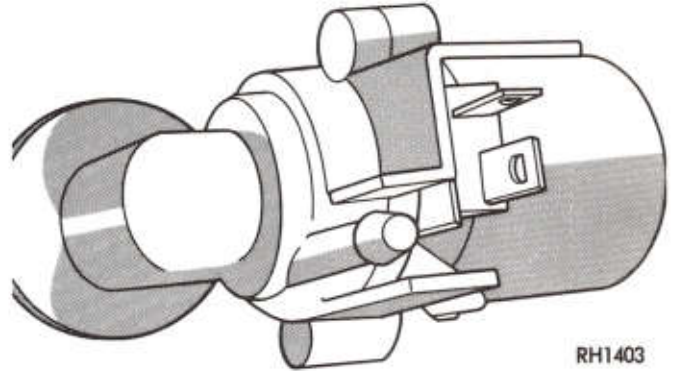


Fig. 2—Washer Pump

EXTERIOR LAMPS

CONTENTS

	Page		Page
HEADLAMP AIMING PROCEDURES	7	SERVICE PROCEDURES	1
HEADLAMP SERVICE PROCEDURES	6	SPECIFICATIONS	10

SERVICE PROCEDURES

INDEX

	Page		Page
Cargo Lamp	1	License Lamps	4
Clearance Lamp	3	Rear Clearance Lamps	4
Courtesy Lamps	6	Side Marker Lamps	1
Front Park and Turn Signal Lamp	1	Tail, Stop, Turn Signal, Side Marker, and	
General Information	1	Back-Up Lamps	1

GENERAL INFORMATION

Each vehicle is equipped with various lamp assemblies which are used for illuminating and/or indicating purposes. A good ground is mandatory for proper light operation. This is provided through the lamp socket to housing to vehicle in some cases. However, in most installations the housing is a plastic part so that an added ground wire is necessary. It is important to have this wire securely connected to a good ground.

When changing bulbs check socket for corrosion. If corrosion is present clean it off with a wire brush and coat socket lightly with any good multi-purpose grease or petroleum jelly.

Bulb identification and application information for exterior and interior lighting can be found in the specifications.

FRONT PARK AND TURN SIGNAL LAMP

To replace bulb, twist out socket from back of housing.

The housing is part of the headlamp bezel and can be replaced by removing four screws from the headlamp bezel.

SIDE MARKER LAMPS

To replace bulb, twist out socket from back of housing (Fig. 2).

Removal

- (1) Twist out socket from back of housing.
- (2) Remove nuts attaching lamp assembly to fender.
- (3) Lift lamp assembly away from outside of fender.

Installation

- (1) Position lamp assembly in fender opening, and install nuts.

- (2) Twist in socket.

CARGO LAMP (Fig. 1)

To replace bulb remove 2 lens screws and remove lens.

Removal

- (1) Remove two mounting screws.
- (2) Pull assembly out and disconnect wiring connectors.

Installation

- (1) Connect wiring to wiring harness.
- (2) Position lamp assembly in place and install two mounting screws.

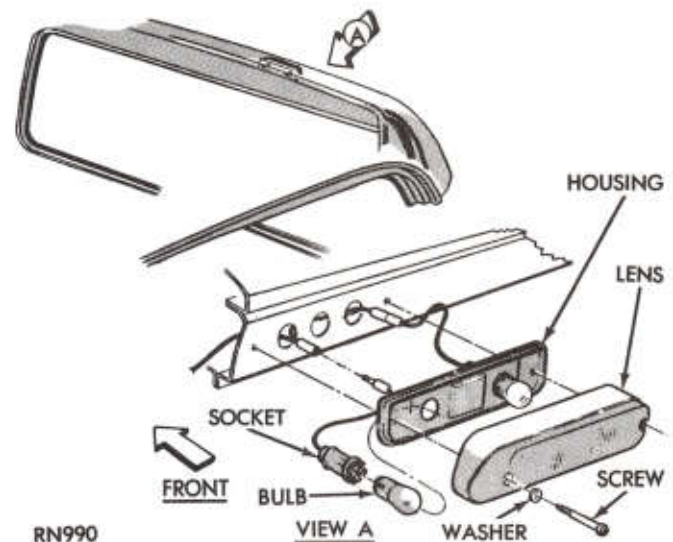
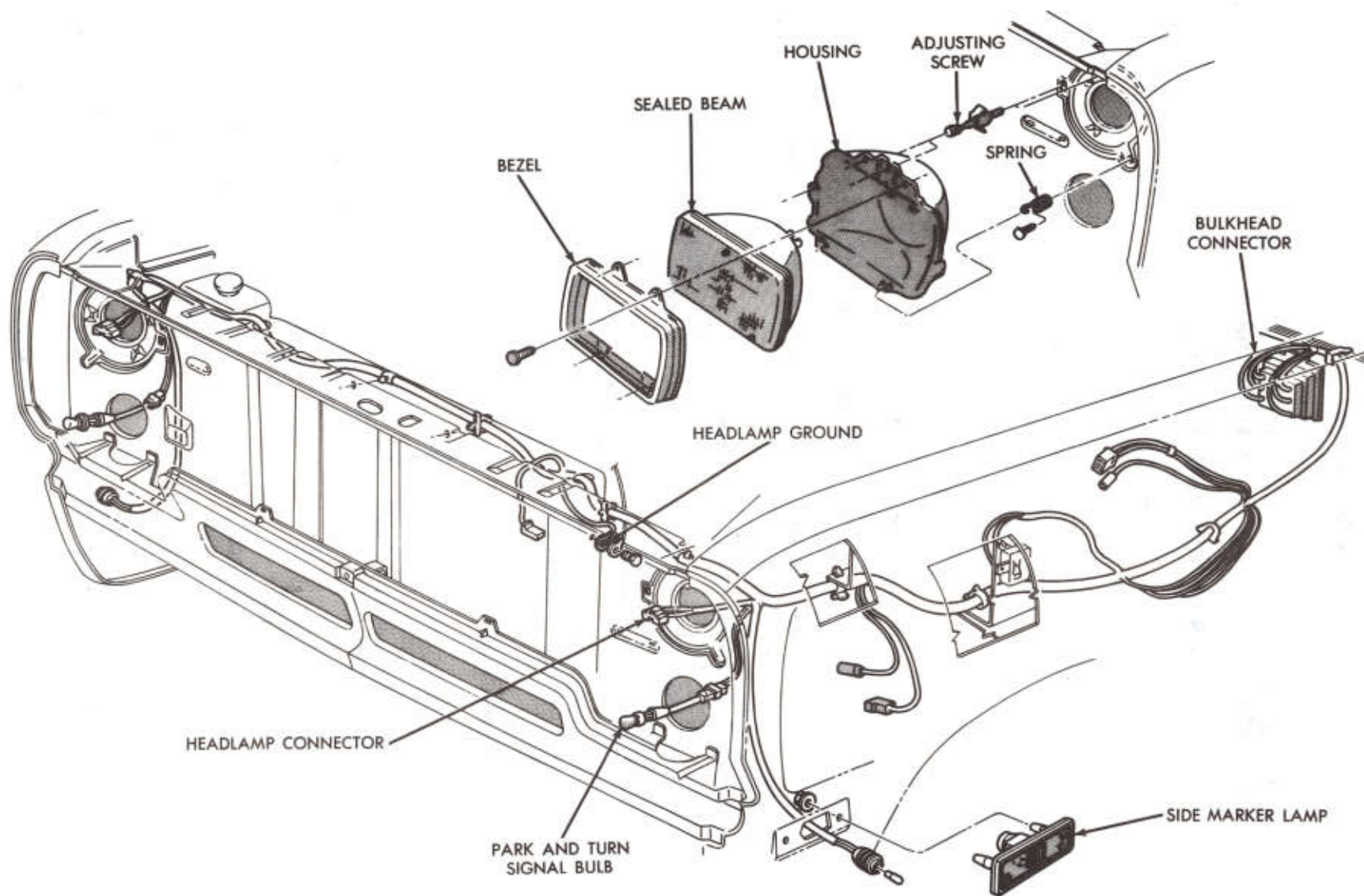


Fig. 1—Cargo Lamp (Optional) Sweptline and Utiline Models



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Fig. 2—Headlamps, Parking, Turn Signal, and Side Marker Lamps

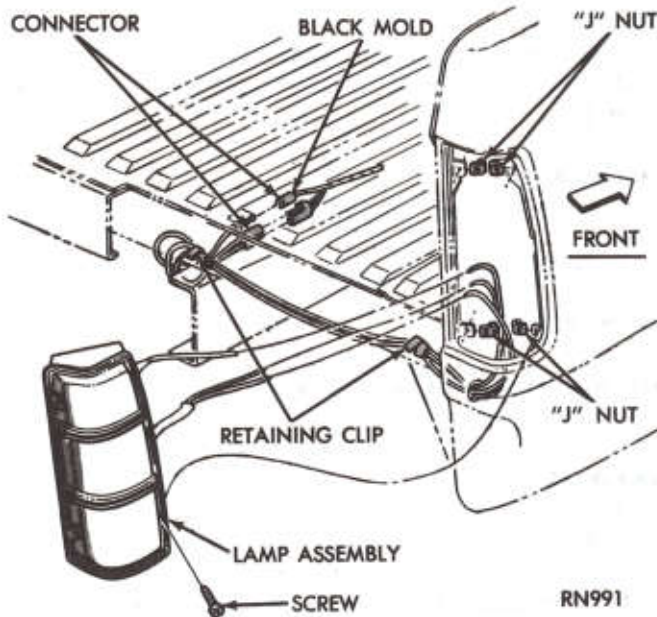


Fig. 3—Tail, Stop, Turn Signal, Side Marker, and Back-Up Lamps

TAIL, STOP, TURN SIGNAL, SIDE MARKER AND BACK-UP LAMPS

Tail, Stop, Turn Signal, Side Marker and Back-Up Lamp Sweptline Models (Fig. 3)

To replace bulbs remove lamp.

Removal

- (1) Remove assembly attachment screws and remove lamp assembly.
- (2) Twist out socket.

Installation

- (1) Twist in socket.
- (2) Position the lamp and install assembly mounting screws.

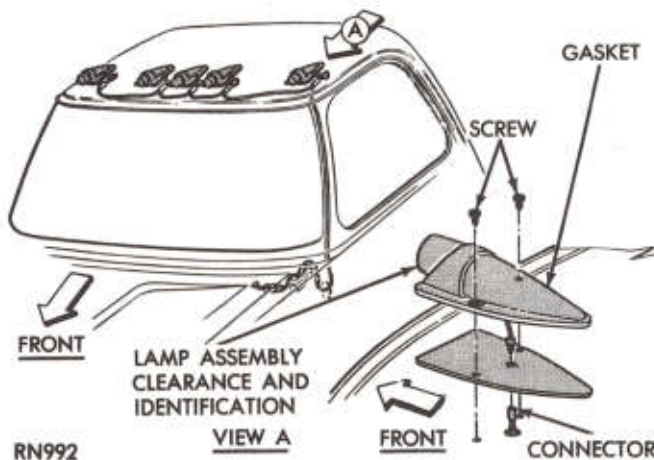


Fig. 4—Clearance and Identification Lamps

CLEARANCE LAMP (Roof-Top) (Fig. 4)

To change bulb remove lamp.

Removal

- (1) Remove mounting screws.
- (2) Lift lamp up and disconnect wires and twist out socket.

Installation

- (1) Connect wires and twist in socket.
- (2) Position lamp and install mounting screws.

Tail, Stop, Turn Signal, Back-Up, and Side Marker Lamps Utiline Models (Fig. 5)

To replace bulbs, remove lens.

Removal

- (1) Disconnect wiring harness.
- (2) Remove lamp mounting nuts and remove assembly.

Installation

- (1) Position lamp to bracket and install two attaching nuts.
- (2) Connect wiring harness.

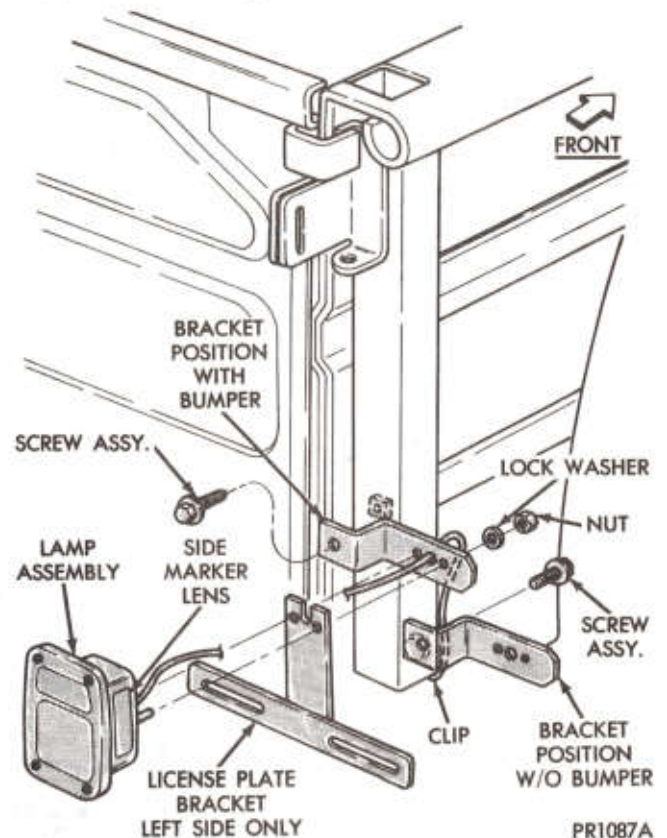


Fig. 5—Tail, Stop, Turn Signal, Back-Up, and Side Marker Lamps (Utiline Models)

Tail, Stop, Turn Signal, and Back-Up Lamp — Cab and Chassis Models (Fig. 6)

To replace bulb remove lens.

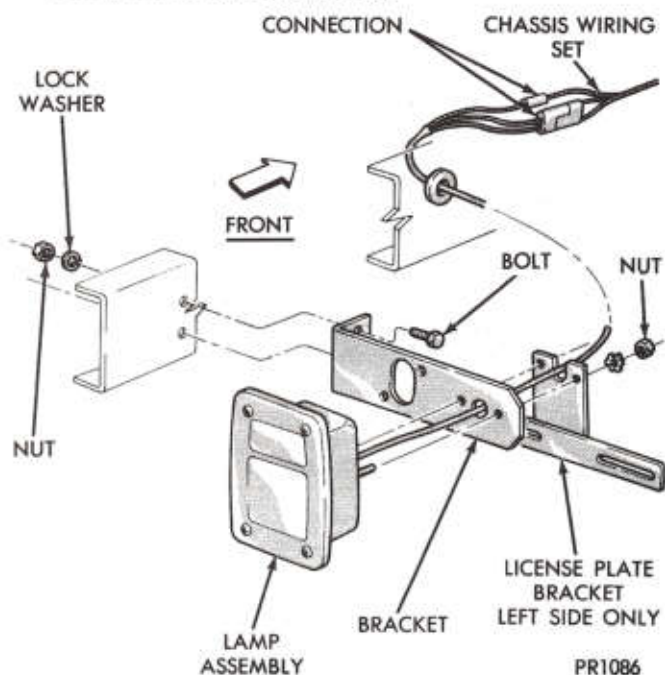


Fig. 6—Tail, Stop, Turn Signal, and Back-Up Lamps; Cab/Chassis Models

Removal

- (1) Disconnect wiring harness.
- (2) Remove two mounting nuts and remove assembly.

Installation

- (1) Position lamp assembly and install mounting screws.
- (2) Connect wiring harness.

LICENSE LAMPS

Bumper License Lamp (Fig. 7)

To replace bulb, remove lens.

Removal

- (1) Remove license plate (standard bumper).
- (2) Remove lens attaching screws and on the standard bumper and housing attaching screws.
- (3) Disconnect lamp wiring from harness and lift assembly off.

Installation

- (1) Position lamp assembly to bumper and install lens and housing attaching screws.
- (2) Connect wiring harness.
- (3) Install license plate (standard bumper).

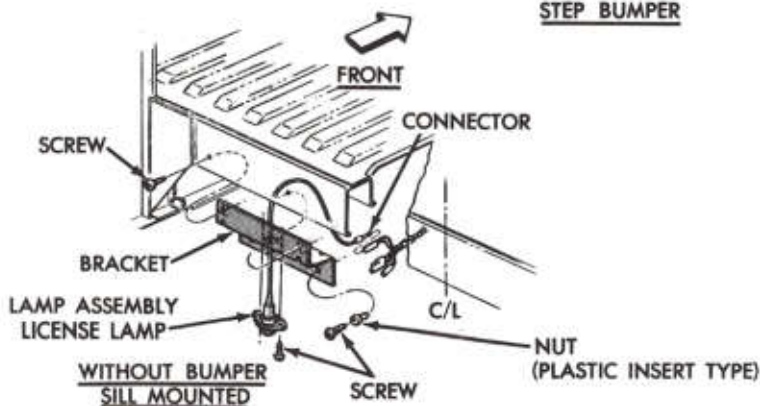
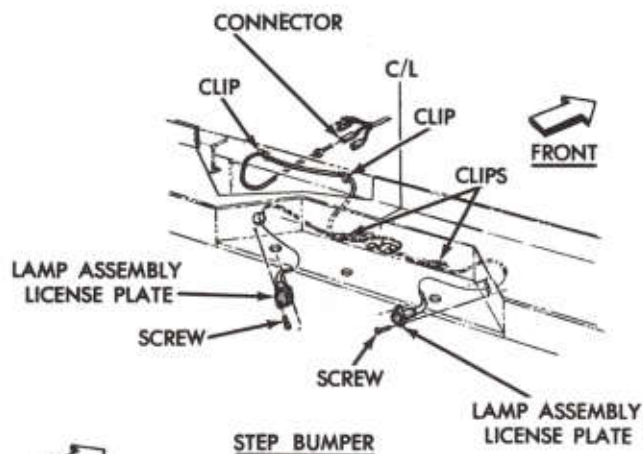
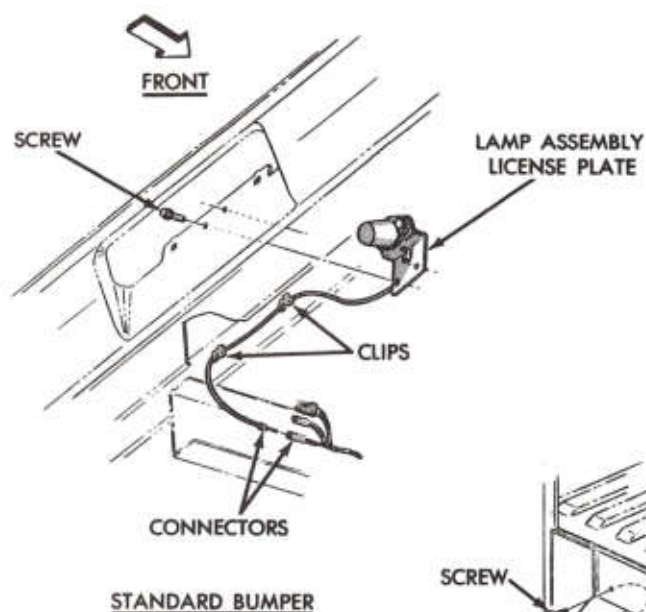


Fig. 7—License Plate Lamps

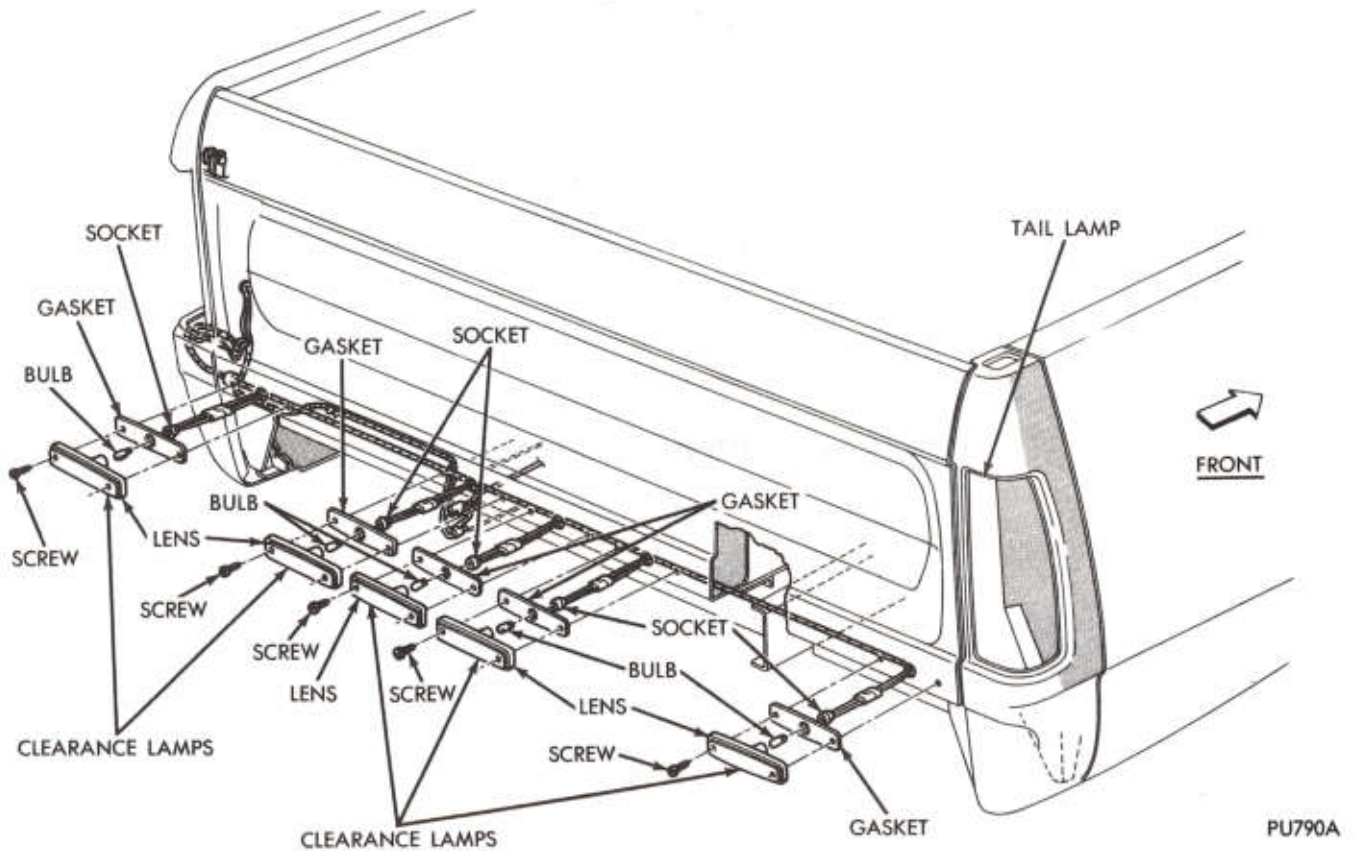


Fig. 8—Rear Clearance Lamps Sweptline with Dual Wheels

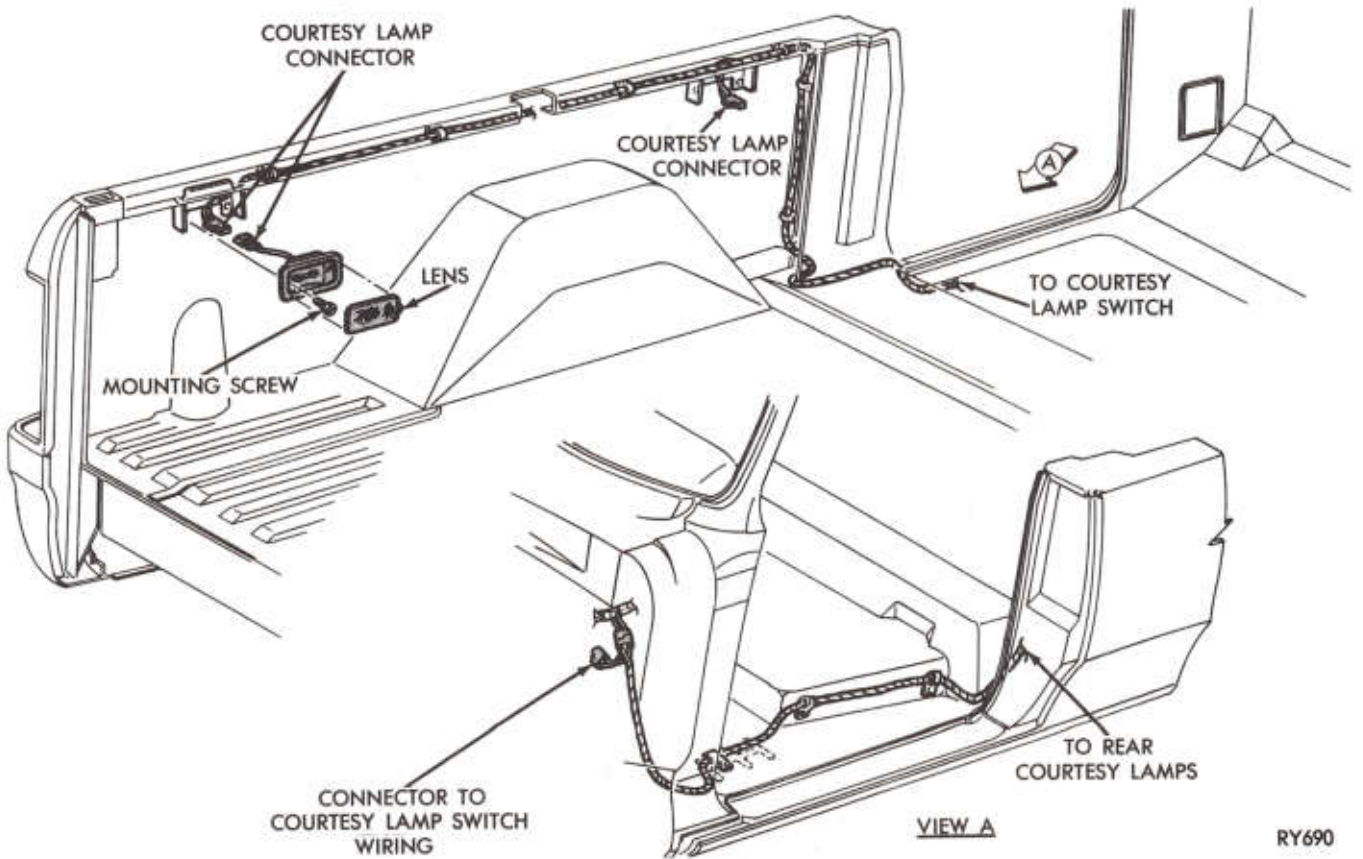


Fig. 9—Courtesy Lamps

Removal

- (1) Remove two attaching screws.
- (2) Slide assembly out far enough to twist out sockets and remove assembly.

Installation

- (1) Twist in socket.
- (2) Position the lamp and install assembly mounting screws.

COURTESY LAMPS

To replace bulbs, remove lens.

Removal

- (1) Remove lens.
- (2) Remove housing screws.
- (3) Disconnect wiring connector and remove assembly.

Installation

- (1) Position assembly to panel and plug in connector.
- (2) Install housing screws.
- (3) Install lens.

HEADLAMP SERVICE PROCEDURES**INDEX**

	Page		Page
General Information	6	Pre Aiming Instructions	7
Headlamp Aiming Procedures	7	Sealed Beam Replacement	6
Compensating Aimers for Floor Slope	7	Testing Aimer Calibration	8
Headlamp Adjustment Using Aiming Screen		Vertical Adjustments	9
Method	9	Headlamp Diagnosis	7
Horizontal Adjustments	9	Headlamp Dimmer Switch	7
Mounting Aimers	9	Headlamp Switch	7

GENERAL INFORMATION

Sealed beam headlamp units are identified by an alpha-numeric coding molded in the lens. The number "1" or "2" designates the number of filaments and the

size and shape is designated by the letters "A," "B," "C," or "D" as shown in Table I.

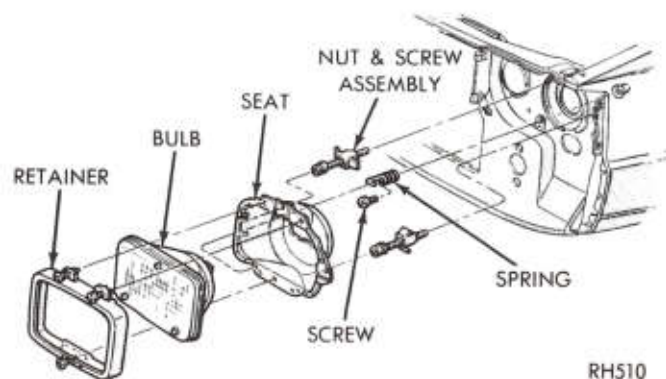
Types B or D are used in two headlamp systems.

TABLE I

Function	Coding	Number of Filaments	Size and Shape
Hi-Beam Only	1a	1	4 x 6.5 inch rectangular
Hi-Lo Beam	2a	2	4 x 6.5 inch rectangular
Hi-Beam Only	1c	1	5-3/4 inch dia. round
Hi-Lo Beam	2c	2	5-3/4 inch dia. round
Hi-Lo Beam	2b	2	5-6 x 7.9 inch rectangular
Hi-Lo Beam	2d	2	7 inch dia. round

Types A or C are used in four headlamp systems. In the four headlamp system one single filament unit (1A or 1C) and one dual-filament unit (2A or 2C) is required on each side of vehicle. The dual filament units are always mounted either outboard of or above the single filament units. The headlamp assemblies are so constructed that the single filament and dual filament units cannot be physically interchanged.

Conventional and halogen headlamp units are physically and electrically interchangeable, but it is recommended that they not be intermixed on a given vehicle.



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Fig. 1—Sealed Beam Replacement Single-Lamp

SEALED BEAM REPLACEMENT (Fig. 1)

The lens, filament and reflector are sealed into one unit which can be removed as follows:

- (1) Remove screws from headlight bezel and remove bezel.
- (2) Remove screws from interior retaining ring, and remove ring. **Do not disturb headlight aimer screws.**
- (3) Pull out sealed beam unit and unplug connector, pulling straight off.
- (4) Install new sealed beam unit.
- (5) Install unit retaining ring.

- (6) Install headlamp bezel.

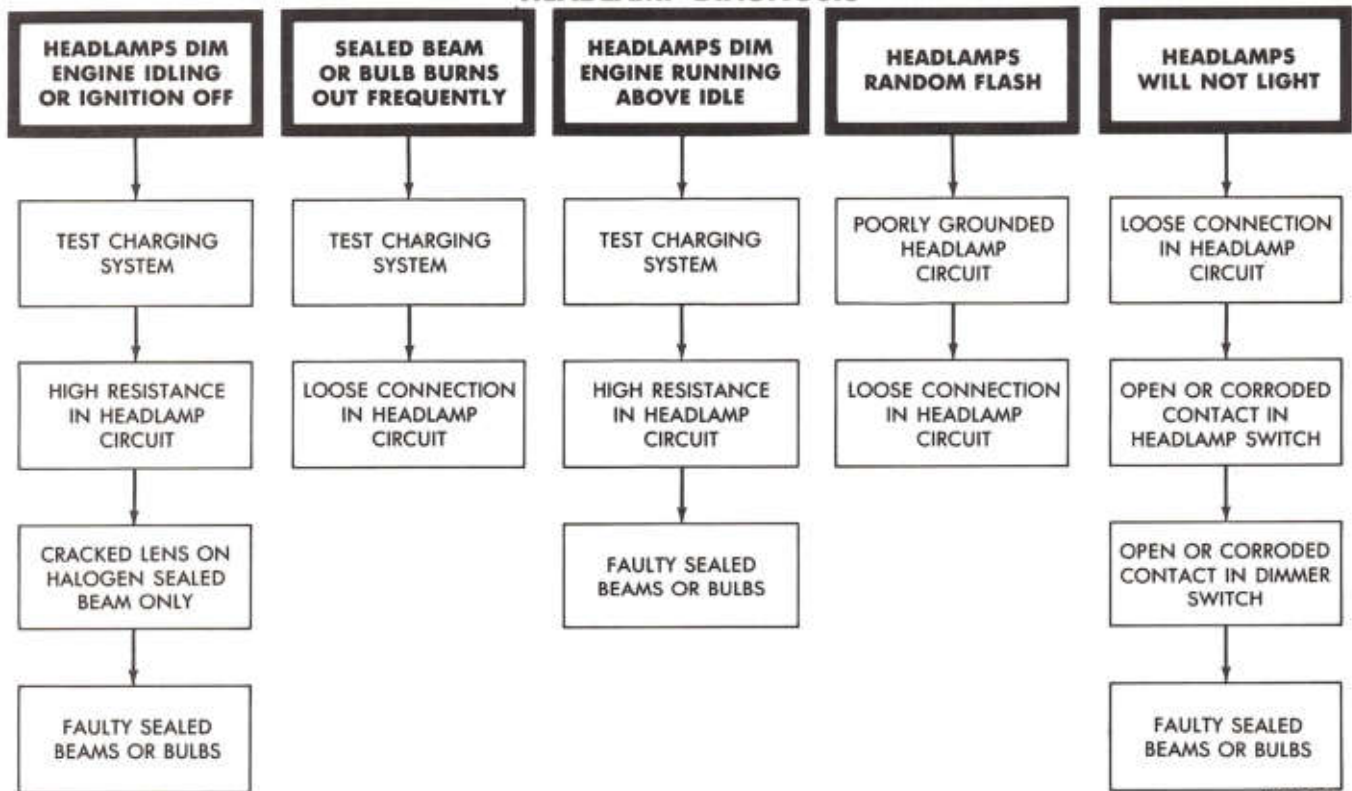
HEADLAMP DIMMER SWITCH

Manual operation of the high-low beam is controlled with a foot operated dimmer switch mounted on the floor pan.

HEADLAMP SWITCH

See Instrument Panel Section in this manual.

HEADLAMP DIAGNOSIS



RR8LD 21

HEADLAMP AIMING PROCEDURES

PRE-AIMING INSTRUCTIONS

- (1) Test dimmer switch operation.
- (2) Observe operation of high beam indicator light mounted in instrument cluster.
- (3) Inspect for badly rusted or faulty headlamp assemblies. These conditions must be corrected before a satisfactory adjustment can be made.
- (4) Place vehicle on a level floor.
- (5) Jounce front suspension through three (3) oscillations by applying body weight to hood or bumper.
- (6) Inspect tire inflation.
- (7) Rock vehicle sideways to allow vehicle to assume its normal position.

- (8) If gasoline tank is not full, place a weight in trunk of vehicle to simulate weight of a full tank (6-1/2 pounds per gallon).

- (9) Thoroughly clean headlight lenses.

COMPENSATING THE AIMERS (C-4466) FOR FLOOR SLOPE

The floor level offset dial must coincide with the floor slope for accurate aiming. Calibration fixtures are included with the aimers.

- (1) Attach one calibration fixture to each aimer. Fixtures will easily snap into position on aimer when properly positioned (Fig. 1).

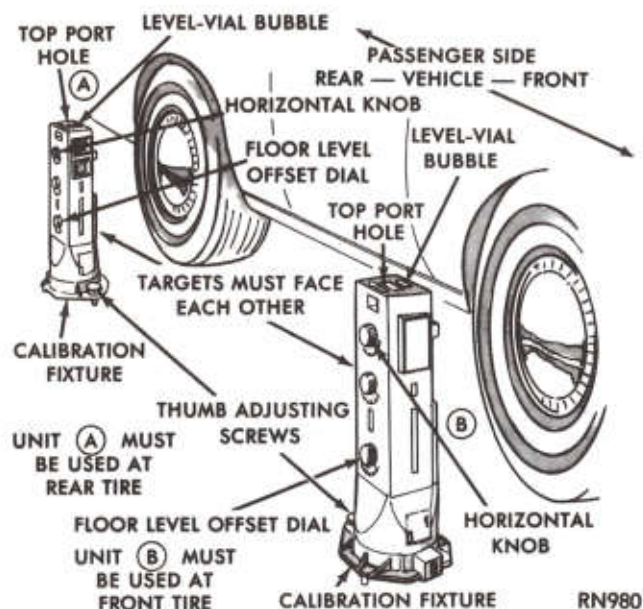


Fig. 1—Determining Floor Slope

(2) Place aimers at centerline of each wheel on one side of vehicle (Fig. 1). Unit A must be placed at rear wheel with target facing forward. Unit B must be placed at front wheel with target facing rearward.

(3) Adjust thumb adjusting screw on each calibration fixture by turning either clockwise or counter-clockwise until level vial bubble registers in a centered, level position (Fig. 1).

(4) Look into top port hole of Unit A. Turn horizontal knob until split image is aligned (Fig. 2 and 3).

(5) Transfer plus or minus reading indicated on horizontal dial to floor level offset dial on each aimer. Press floor level dial inward to set reading (Fig. 3).

(6) Remove calibration fixtures from both units.

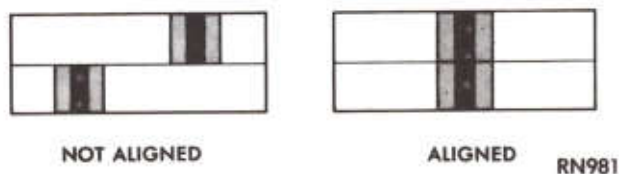


Fig. 2—Split Image Alignment

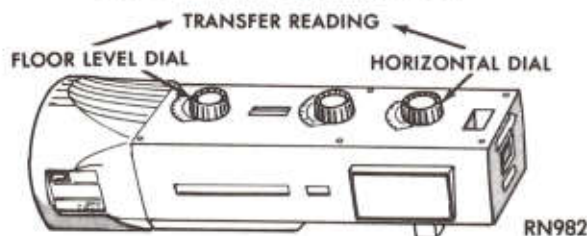


Fig. 3—Floor Level Compensating Adjustment



Fig. 4—Calibration Fixture

TESTING AIMER CALIBRATION

Calibration of the aimers may be lost due to extended use. Calibration fixtures used in conjunction with aimers can be used to check and adjust aimers.

(1) Turn thumb adjusting screw on each calibration fixture until it is approximately the same distance as the supporting posts (Fig. 4).

(2) Attach calibration fixtures to each unit with level vials on top (Fig. 4).

(3) Locate a true vertical plate glass window or smooth surface and secure aimers three to five feet apart so split image targets can be located in viewing ports (Fig. 5).

(4) Set floor level dial at zero (Fig. 1).

(5) Rotate thumb adjusting screws on each calibration fixture until level vials on fixtures are centered (Fig. 6).

(6) With both calibration level vials centered turn vertical dial knobs on each aimer until aimer level vials are centered. If aimer vertical dial pointers read between 1/2 up and 1/2 down, aimers are within allowable vertical tolerance. Recalibrate units if beyond these limits (Fig. 6).

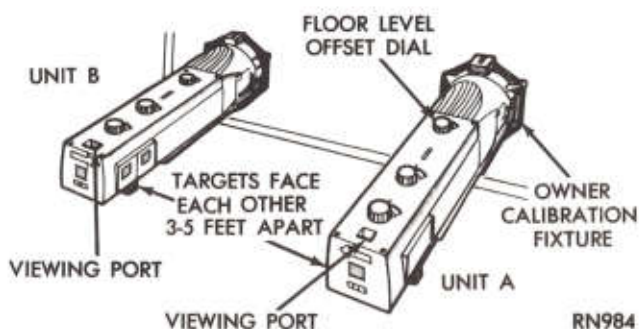


Fig. 5—Checking Aimer Calibration

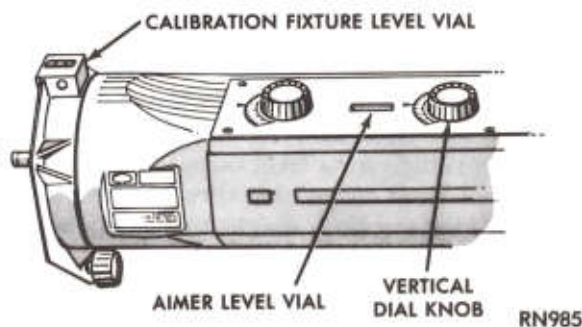


Fig. 6—Checking Vertical Aim Calibration

(7) Adjust horizontal dial knob on each aimer until split image targets align. If aimer horizontal dial pointers read between 1 left and 1 right, the aimers are within allowable tolerance limits. Recalibrate units if beyond these limits (Fig. 3).

MOUNTING AIMERS

(1) Snap proper adaptor into position on each aimer (Fig. 7).

(2) Position aimers on headlamps by pushing piston handle forward, engaging rubber suction cup. Immediately pull back piston handle until it locks in place (Fig. 8).

Steel inserts are moulded into position on all adaptors to insure accuracy. These inserts must be in contact with the three guide points on the lamps when the aimers are properly positioned.

HORIZONTAL ADJUSTMENT

(1) Set horizontal dial to zero (Fig. 3).

(2) Check to see that the split image target lines are visible in the viewing port. If necessary, rotate each aimer slightly to locate the target (Fig. 9).

(3) Turn horizontal screw on side of headlamp until split image of target line appears in mirrors as one solid line (Fig. 9). To remove "backlash," make final adjustment by turning adjusting screw in a clockwise direction.

(4) Repeat the last three steps on opposite headlamp.

VERTICAL ADJUSTMENT

(1) The vertical dial should be set at zero. (For passenger vehicles, a "0" setting is generally required. For special setting, consult local state laws.)



PR263 A

Fig. 7—Headlamp Adaptors

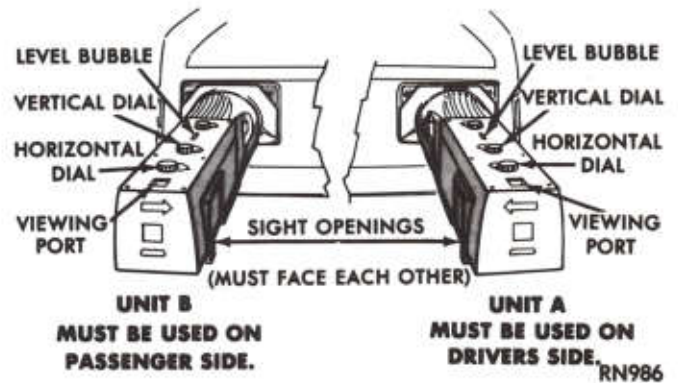


Fig. 8—Headlamp Aimers in Position

(2) Turn vertical adjusting screw (Fig. 6) until the level bubble is centered between the lines (Fig. 9).

(3) Repeat the last two steps on the opposite headlamp.

(4) Re-check target alignment on both aimers and readjust horizontal aim if necessary.

(5) Repeat aiming process for a four headlamp system on the second pair of lamps.

(6) Remove aimers by pressing "vacuum release" button located on piston handle.

HEADLAMP ADJUSTMENT USING AIMING SCREEN METHOD

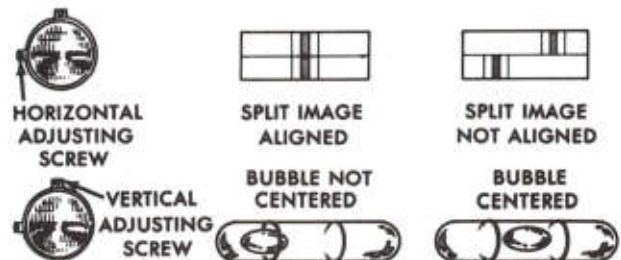
Place vehicle on a known level floor 25 feet (762 cm) from aiming screen or other light colored area. Prepare aiming screen as follows:

(1) Position a vertical tape so that it is aligned with the vehicle centerline.

(2) Position a horizontal tape with reference to centerline of headlamp.

(3) Position a vertical tape on the screen with reference to the centerline of each headlamp. A four headlamp system will have four vertical tapes plus the vehicle centerline tape. A two headlamp system will have two vertical tapes plus the vehicle centerline tape.

(4) Open headlamp doors, if so equipped. Adjust top adjusting screw for vertical adjustment, adjust side screw for horizontal adjustment.



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Fig. 9—Split Image and Bubble Alignment and Headlamp Adjusting Points

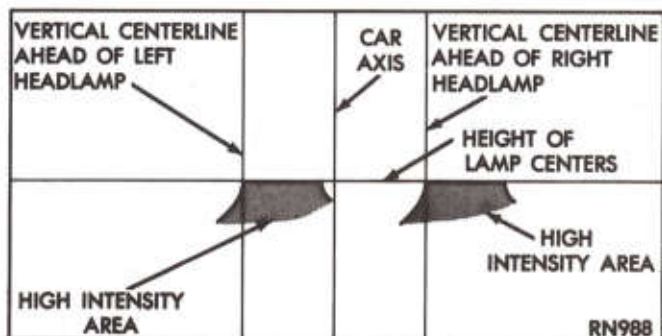


Fig. 10—Low Beam Adjust Pattern

(5) Headlamps should be aimed by means of the low beam. A properly aimed low beam will appear on a screen 25 feet (762 cm) in front of the vehicle similar to the pattern shown in Fig. 10.

SPECIFICATIONS

INTERIOR LAMP BULBS

Headlight Switch Rheostat Dimming		Non-Dimming	
Air Conditioning Control Illumination	# 161	Four Wheel Drive Indicator	# 194
Ash Tray Illumination	# 161	Gate Ajar Indicator Lamp	# 158
Clock Electronic	(Note A)	Glove Compartment Lamp	# 1891
Gear Shift Selector (Note B)	# 194	High Beam Indicator Lamp	# 194
Heater Control Illumination	# 161	Low Voltage Indicator Lamp	# 194
Instrument Cluster Illumination	# 194	Maintenance Required	# 194
Radio All (ETSR) (Note D) Illumination	# 74	Map Lamp	# 562
Radio Ultimate Sound System	(Note D)	Oil Pressure Indicator Lamp	# 194
Snow Plow Control Illumination	# 161	Temperature Indicator Lamp	# 194
Brake Indicator Lamp	# 194	Turn Signal Indicator Lamp	# 194
		Rear Cargo Lamp	# 211-2
		Ignition Key Lamp	# 53
		Dome Lamp	# 1004
		Fasten Seat Belt Indicator Lamp	# 194

NOTE: (A) Included in Radio. (B) Included in instrument cluster lighting. (C) Light Emitting Diode.

(D) Warranty service by authorized service dealer only.

(E) All bulbs are brass or glass wedge base. Aluminum bulbs are not approved and are not to be used.

EXTERIOR LIGHT BULBS

Auxiliary Headlamps (Snow Plow)	# 6054	Park and Turn Signal (Snow Plow) Lamp	# 2057
Back-Up Lamps	# 1156	Rear Bumper License Plate Lamp	
Cargo Lamp	# 922	Standard Chrome Bumper	# 1155
Clearance and Side Marker Lamps	# 194	Sill Mounted (No Bumper)	# 168
Front Side Marker Lamp	# 168	Step Bumper	# 168
Headlamps, Rectangular	# 6052	Rear Side Marker Lamp (Sweptline) Note A	# 2057
Headlamp, Rectangular, Optional Halogen	# H6054	Tail and Stop Lamp (Sweptline)	# 2057
Front Park and Turn Signal Lamp	# 2057		

NOTE: (A) Tail Lamp Bulb Also Serves As Side Marker Lamp

H - Halogen Headlamp

CIRCUIT BREAKERS

Circuit	Amp.	Location
Headlights	20	Integral with Switch

SEAT BELT WARNING SYSTEM

INDEX

	Page		Page
General Information	1	System Diagnosis	2
Seatbelt Buckle Switch Test	1	Timed Buzzer Relay Test	1

GENERAL INFORMATION

The seat belt warning system uses a lamp on the instrument panel and a buzzer for both visual and audible warning signals. The buzzer is a combined "seat belt not fastened", "key left in ignition" and "headlamps left on" signal.

The seat belt portion of the buzzer includes a timer. The system will always illuminate the seat belt warning lamp for 4 to 8 seconds after the ignition switch is turned to the ON position. Also, if the driver does not fasten his seat belt, the buzzer will sound during the same interval. Only the driver's seat belt buckle has a switch that is connected to this system. Passenger seat belts are not connected to this system.

The seat belt warning buzzer is located to the right of the steering column on the back side of the instrument panel (Fig. 1).

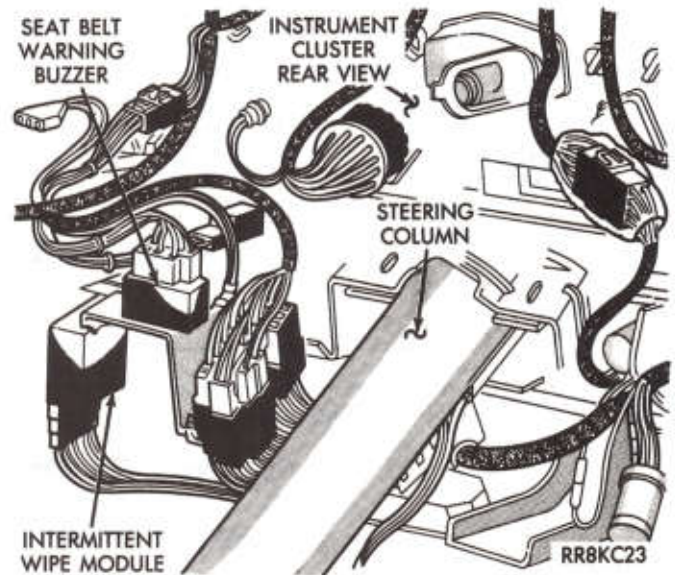


Fig. 1—Seat Belt Warning Buzzer Location

TEST PROCEDURES

TIMED BUZZER-RELAY TEST (Fig. 2)

Preparation

- (1) Remove timed buzzer-relay.
- (2) Connect one end of a jumper wire to a 12 volt supply.
- (3) Connect a test lamp between terminal number 3 of relay and ground.
- (4) Ground terminals 2 and 5 of relay.

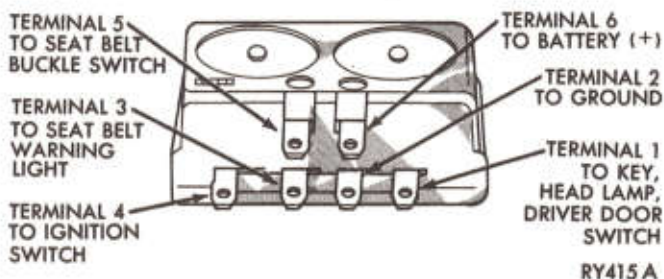


Fig. 2—Timed Buzzer-Relay Terminal Identification

Test Procedure

Connect 12 volt jumper wire to terminal number 4 of timed buzzer-relay, look at test lamp and listen for buzzer.

Results

- (1) Light should come on and buzzer should sound for 4 to 8 seconds and then both should go off; if not, replace timed buzzer-relay.
- (2) If operation is okay, check all wiring in vehicle for opens, shorts, or poor connections.

SEAT BELT BUCKLE SWITCH TEST (Fig. 3)

Test timed buzzer-relay and if it checks out okay, check wiring from terminal number five to seat belt switch and the wire from seat belt switch to terminal number two (ground). If they check out okay, replace seat belt buckle and switch assembly.

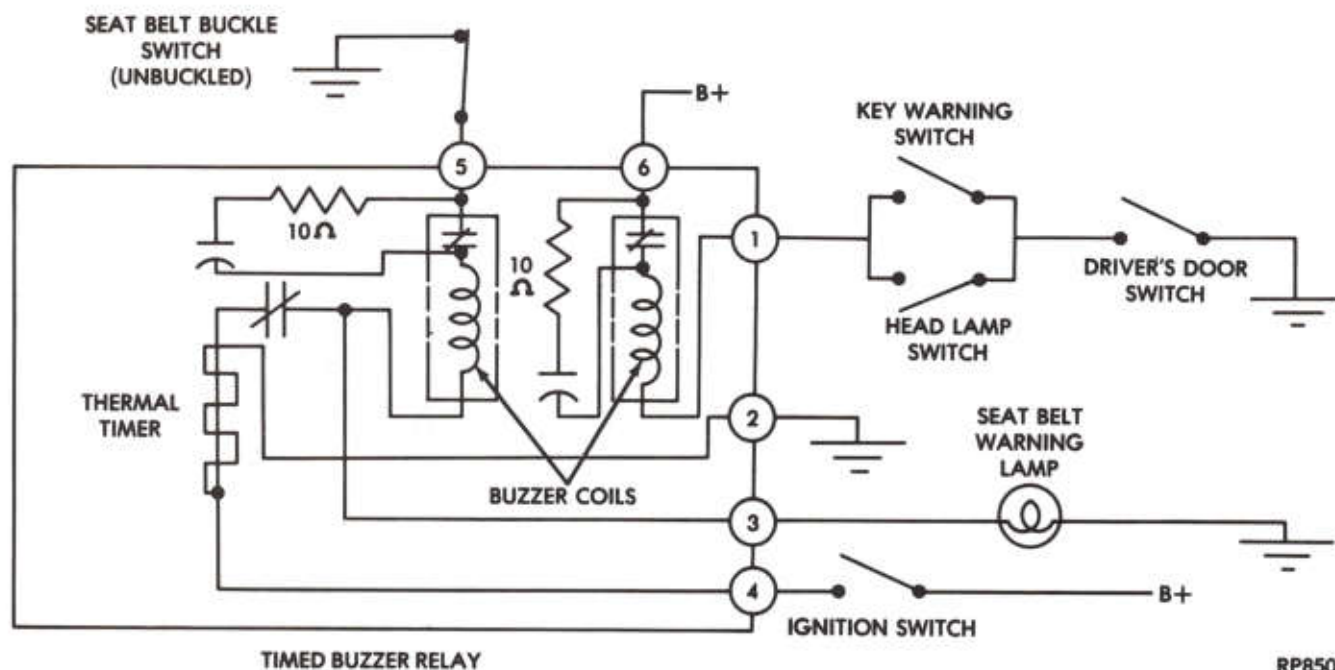
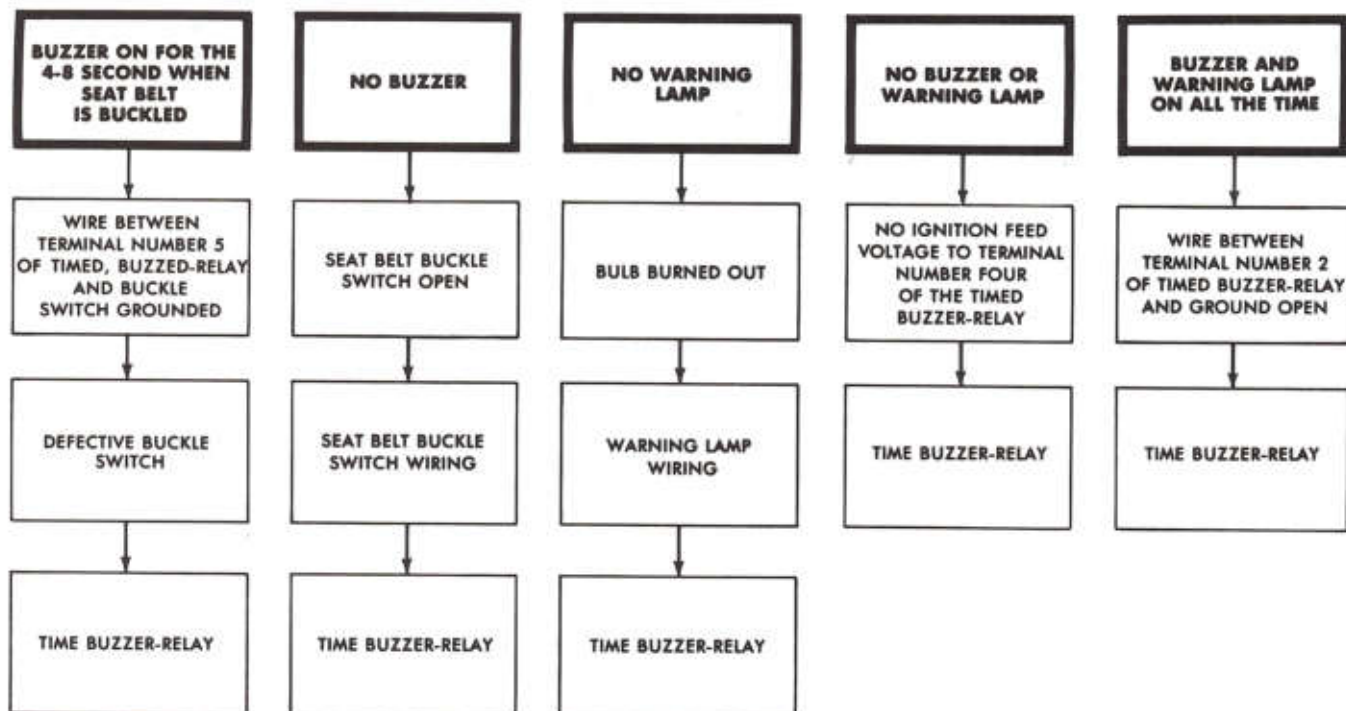


Fig. 3—Seat Belt Warning System Wiring Schematic

SEAT BELT WARNING SYSTEM DIAGNOSIS



ELECTRIC LOCKS

INDEX

	Page		Page
General Information	1	Test Procedures	
Service Procedures		Circuit Breaker Test	1
Door Lock Motor Replacement	2	Electric Motor Test	2
		Switch Test	1
		Switch Voltage Test	1

GENERAL INFORMATION

Both doors, when electrically equipped, can be locked or unlocked electrically by operating the switch on a door panel.

Both doors can be locked or unlocked mechanically with the locking knob regardless of electrical locking and unlocking actuation.

The right and left door on all vehicles can be locked or unlocked mechanically from the outside with the key or electrically as described above. The left door can also be unlocked by actuation of the inside remote door handle.

TEST PROCEDURES

CIRCUIT BREAKER TEST

Find correct circuit breaker on fuse block. Pull out slightly but be sure that circuit breaker terminals still contact terminals in fuse block. Connect ground wire of voltmeter to a good ground. With probe of voltmeter positive wire, check both terminals of circuit breaker for battery voltage. If only one terminal checks at battery voltage, circuit breaker is defective and must be replaced. If neither terminal shows battery voltage, check for open or shorted circuit to circuit breaker.

SWITCH TEST (Fig. 1)

To test the switches connect jumper wires at right side switch connector as shown in (Fig. 1). These jumper wires connected in this way take the place of a switch in the inactive position. Then operate the locks using the left connector and jumper wires. Connecting the OR to RD and the PK to BK should lock the doors. Connecting the PK to RD and the OR to BK should unlock the doors. If locks operate using the jumper wires the fault is in the switch.

SWITCH VOLTAGE TEST

The following wiring test sequence determines whether or not voltage is continuous through the body harness to switch.

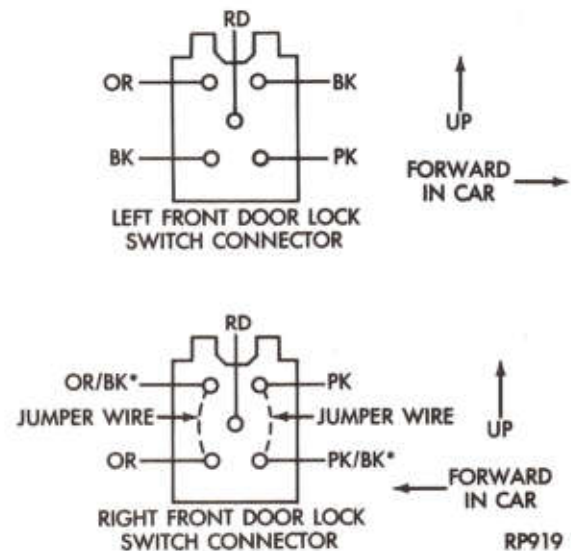


Fig. 1—Door Lock Switch Connectors

After removing switch from trim panel for testing purposes, carefully separate multiple terminal block on wiring harness from switch body. Connect one lead of test light to black wire terminal and touch other test light lead to red wire terminal. If the test light comes on, the wiring circuit between the battery and switch is functional. If light does not come on, check 30 amp main fuse (circuit breaker) or for a broken wire.

ELECTRIC MOTOR TEST

Make certain battery is in normal condition before circuits are tested.

To determine which motor is faulty, check each individual door for electrical lock and unlock or disconnect the motor connectors one at a time, while

operating the door lock switch. In the event that none of the motors work, the problem may be caused by a shorted motor. Disconnecting the defective motor will allow the other to work.

Should the motor defect be a result of a broken pigtail wire, it should have no effect on the operation of the other motors.

SERVICE PROCEDURES

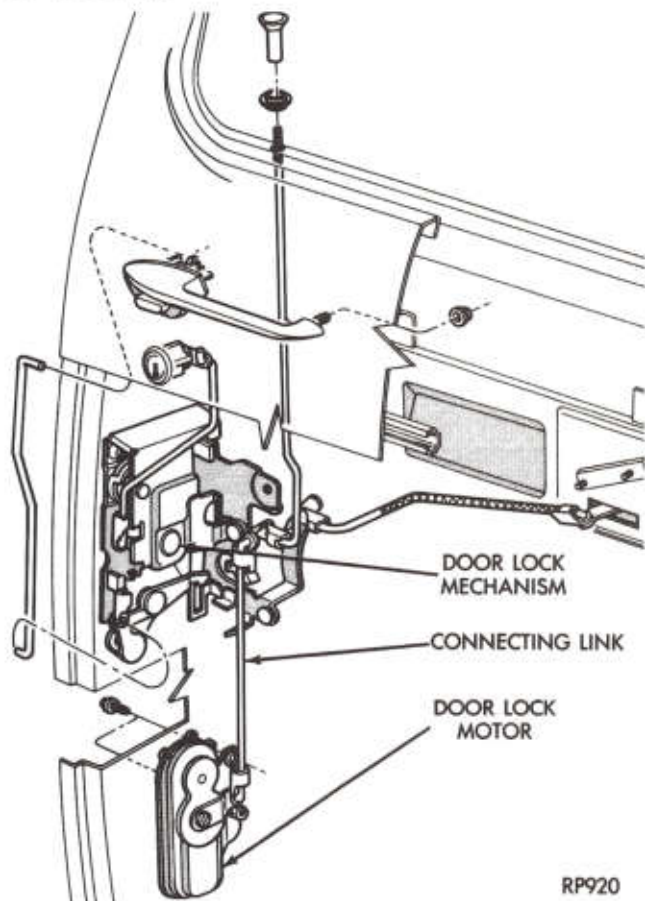
DOOR LOCK MOTOR REPLACEMENT (Fig. 2)

Removal

- (1) Remove inside door release handle, window regulator handle and door trim panel.
- (2) Roll door watershield away from lower rear corner of door to reveal inside panel access opening.
- (3) Remove motor link at motor.
- (4) Disconnect motor lead wires.
- (5) Remove motor mounting bracket screws (2) and remove motor assembly from mounting.

Installation

- (1) Attach motor mounting bracket to door inside panel and install screws (2).
- (2) Connect link to motor rod and connect wires.
- (3) Reset watershield at lower rear corner of door.
- (4) Install window regulator handle, door inside release lever handle and door trim panel.



RP920

Fig. 2—Door Lock Motor Replacement

POWER WINDOWS

INDEX

	Page		Page
General Information	1	Test Procedures	
Service Procedures		Circuit Breaker Test	3
Gear and Pinion Replacement	4	Switch Test	3
Motor and Regulator Bench Repair	4	Switch Voltage Test	3
Motor and Regulator Replacement	4	Window Lift Motor Test	3

GENERAL INFORMATION

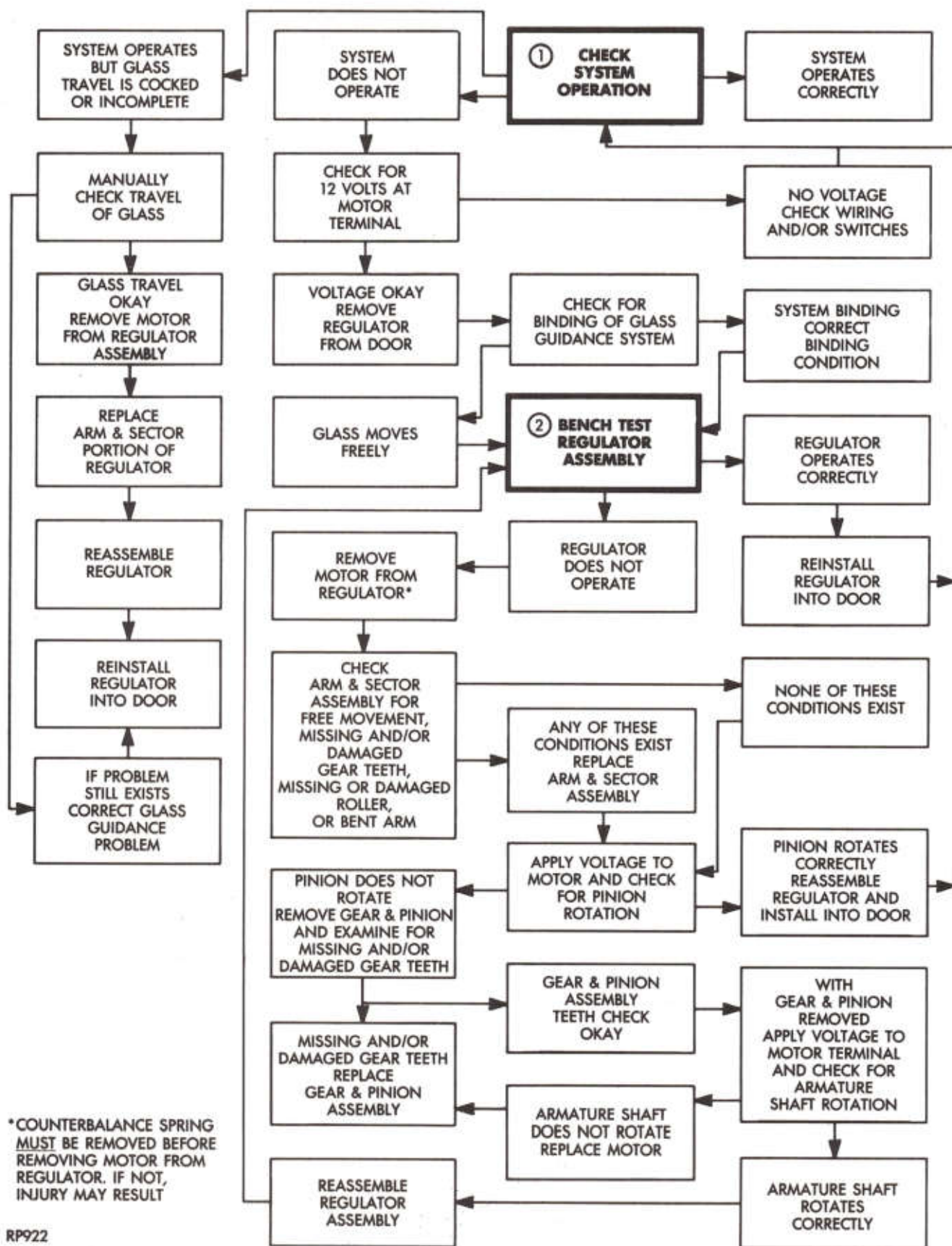
Window lift motors are of the permanent magnet type. A positive and negative battery connection to either of the two motor terminals will cause the motor to rotate in one direction. Reversing current through these same two connections will cause the motor to rotate in the opposite direction.

It is necessary that the window be free to slide up and down in the glass channels or tubes and tracks. If the window is not free to move up and down, the window lift motor will not be able to move the glass.

The most positive way to determine if the glass is free is to disconnect the electric window regulator lift arm sliders from the glass lift channels and then slide the window up and down by hand.

A less positive method is to shake the glass in the door, (with glass positioned between the up and down stop positions). If the glass will move slightly from side to side, front to rear, and up and down, then there is a good chance that the window is not bound tight in the tracks.

POWER WINDOW SYSTEM DIAGNOSIS



*COUNTERBALANCE SPRING MUST BE REMOVED BEFORE REMOVING MOTOR FROM REGULATOR. IF NOT, INJURY MAY RESULT

TEST PROCEDURES

SWITCH VOLTAGE TEST

The following wiring test sequence determines whether or not voltage is continuous through the body harness to switch.

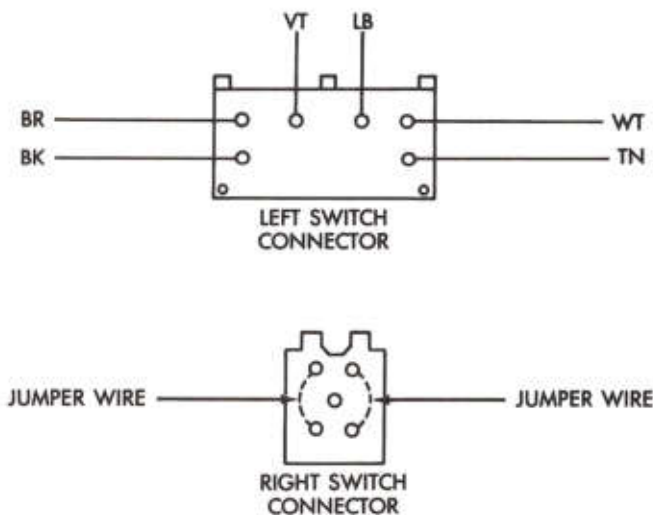
After removing switch from trim panel for testing purposes, carefully separate multiple terminal block on wiring harness from switch body. Connect one lead of test light to white wire terminal and touch other test light lead to tan wire terminal. If the test light comes on, the wiring circuit between the battery and switch is functional. If light does not come on, check 30 amp main fuse (circuit breaker), a broken wire or poor ground.

CIRCUIT BREAKER TEST

Find correct circuit breaker on fuse block. Pull out slightly but be sure that circuit breaker terminals still

MOVEMENT
LEFT FRONT UP
LEFT FRONT DOWN
RIGHT FRONT UP
RIGHT FRONT DOWN

JUMP WIRES
LB TO TN AND WT TO BK
WT TO TN AND LB TO BK
BR TO TN AND VT TO BK
VT TO TN AND BR TO BK



RP921

Fig. 1—Window Switch Test

contact terminals in fuse block. Connect ground wire of voltmeter to a good ground. With probe of voltmeter positive wire, check both terminals of circuit breaker for battery voltage. If only one terminal checks at battery voltage, circuit breaker is defective and must be replaced. If neither terminal shows battery voltage, check for open or shorted circuit to circuit breaker.

SWITCH TEST

(1) If the failure is in the right side door, connect jumper wires to that switch connector as shown in (Fig. 1).

(2) Check operation of window motor by making jumper connections on the left main switch connector, as shown in (Fig. 1). If the failure is in the left door, it is not necessary to disconnect or jump the other switch.

(a) If the window motor operates using jumper wires, a switch is the cause of failure.

(b) If the window motor does not operate using jumper wires, perform the "Window Lift Motor Test".

WINDOW LIFT MOTOR TEST

(1) Connect positive lead (from a test battery) to either of the two motor terminals.

(2) Connect negative lead (from test battery) to remaining motor terminal.

(3) The motor should now rotate in one direction to either move window up or down.

(a) If window happens to already be in full UP position and motor is connected so as to rotate in UP direction no movement will be observed.

(b) Likewise, motor connected to DOWN direction rotation, no movement will be observed if window is already in full down position.

(4) Reverse battery leads (opposite to steps 1 and 2) and window should now move. If window does not move, remove motor. See below for motor removal from vehicle for bench test.

(5) If window moved completely up or down, motor should be reversed one more time (reverse leads from step 4) to complete a full window travel inspection.

SERVICE PROCEDURES

GEAR AND PINION REPLACEMENT AND LUBRICATION

When gear and pinion assembly is replaced in gear box, lubrication of gear box, gear pinion and seal is necessary if these parts have been disassembled.

In the event there is no lubricant in gear box, fill with MOPAR, multi-mileage lubricant or equivalent. Apply a liberal amount of lubricant to inside area of seal and sealing surface at center area of gear and pinion coupling. Also lubricate center housing shaft and worm gear.

REGULATOR AND MOTOR ASSEMBLY

Removal

To repair or inspect the entire electric window regulator, remove from door as follows:

- (1) Disconnect wiring connector from motor.
- (2) Remove three (3) attaching rivets that hold regulator to inner panel (Fig. 2). Remove screw that secures motor tie down bracket to inner panel if so equipped.
- (3) Maneuver regulator assembly by hand to disengage the drive arm slider from the glass lift channel. Remove from door.

Bench Repair

If entire regulator is not being replaced, repair as follows:

- (1) Remove regulator as described above.
- STEPS (2) AND (3) ARE VERY IMPORTANT. IF NOT DONE BEFORE MOTOR REMOVAL INJURY MAY RESULT.**
- (2) Secure regulator in vise to prevent sector gear from rotating.
- (3) Remove counter balance spring. (Must be done for safety before removing motor).
- (4) Remove three (3) motor attaching screws and remove motor.

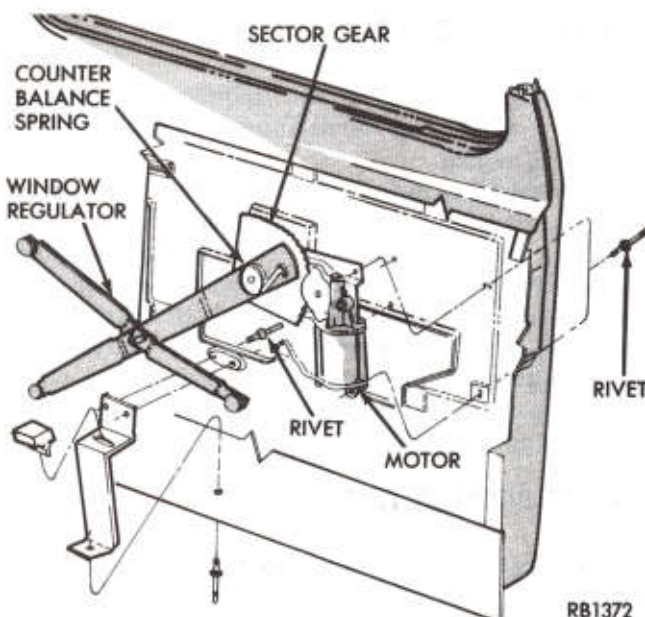


Fig. 2—Electric Window Regulator Mounting

- (5) Inspect regulator for:
 - (a) Sector gear teeth must not be broken or severely worn.
 - (b) All rivets and sliders must be securely attached.
 - (c) Parts must not be bent or cracked.
 - (d) Sector gear must rotate freely.
 - (e) Perform window lift motor test as described above.
- (6) Install motor and attach with three motor attaching screws.
- (7) Install counter balance spring.

Installation

- (1) Install regulator in door by reversing removal procedure steps 1, 2 and 3.
- (2) Regulator may be secured to door panel using rivets or 1/4-20 x 1/2 screws and nuts.

POWER MIRRORS

CONTENTS

GENERAL INFORMATION	Page 1	TEST PROCEDURES	Page 1
SERVICE PROCEDURES	2		

GENERAL INFORMATION

Electrically-operated remote control mirrors are available as an option on D-body vehicles. The mirrors are controlled by a single switch assembly located on the instrument panel directly to the right of the headlamp switch (Fig. 1).

D-body vehicles use a toggle-type switch which is rotated clockwise (Right mirror) or counterclockwise (Left mirror) for mirror selection, and moved UP, DOWN, RIGHT, or LEFT for mirror movement direction.

The motors which operate the mirrors are part of the mirror assembly and cannot be serviced separately.

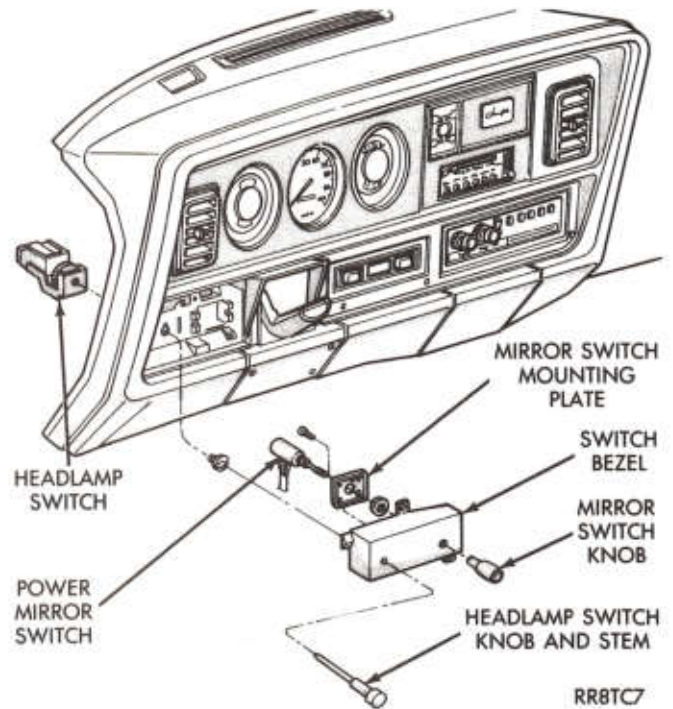


Fig. 1—Power Mirror and Headlamp Switches

TEST PROCEDURES

INDEX

Mirror Motor Test	Page 1	Mirror Switch Test	Page 2
-------------------------	--------	--------------------------	--------

Mirror Motor Test Procedure

- (1) Remove power mirror switch from mounting position.
- (2) Disconnect wiring harness at switch connector.
- (3) Using jumper wires (2), one connected to a 12-volt source, and the other connected to a good body ground, refer to the MIRROR TEST CHART for wire hookups at the switch connector (harness side, not switch side).
- (4) If results shown in chart are not obtained, check for broken or shorted circuit, or replace mirror assembly as necessary.

MIRROR TEST CHART			
12 Volts	Ground	MIRROR REACTION	
		Right	Left
YL/BK	WT/BK	UP	
YL	WT		UP
WT/BK	YL/BK	DOWN	
WT	YL		DOWN
WT/BK	DB/WT	RIGHT	
WT	DB		RIGHT
DB/WT	WT/BK	LEFT	
DB	WT		LEFT

Mirror Switch Test Procedure

(1) Remove power mirror switch from mounting position.

(2) Disconnect wiring harness at switch connector.

(3) Using a continuity tester or ohmmeter, test for continuity (no resistance) between the terminals of the switch as shown in the MIRROR SWITCH CONTINUITY CHART.

(4) If results shown in the chart are not obtained, replace the switch.

MIRROR SWITCH CONTINUITY CHART	
Mirror Selector Knob in "L" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	YL/BK and PK, WT and BK YL and PK
▶	WT and PK, DB and BK DB/WT and BK
▼	WT and PK, YL and BK YL/BK and BK
◀	WT and BK, DB and PK DB/WT and PK
Mirror Selector Knob in "R" Position	
MOVE LEVER	CONTINUITY BETWEEN
▲	WT/BK and BK, YL and PK YL/BK and PK
▶	WT/BK and PK, DB and BK DB/WT and BK
▼	WT/BK and PK, YL and BK YL/BK and BK
◀	WT/BK and BK, DB and PK DB/WT and PK

SERVICE PROCEDURES**INDEX**

Mirror Assembly Replacement Page 2

Mirror Switch Replacement Page 2

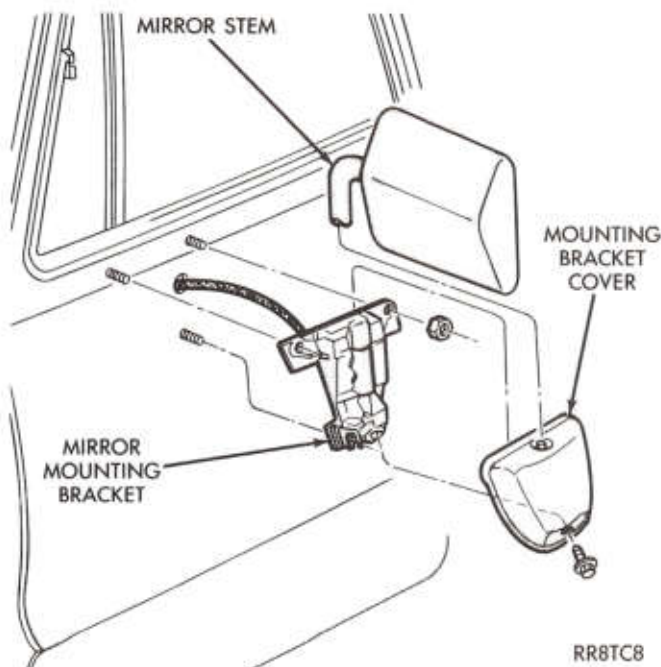
Mirror Switch Replacement (Fig. 1)**Removal**

- (1) Remove instrument cluster bezel assembly.
 - (2) Reach under instrument panel and disconnect mirror switch connector.
 - (3) Remove headlamp switch knob and stem by depressing button on side of switch and pulling stem out.
 - (4) Remove switch bezel retaining screws and pull bezel out of instrument panel.
 - (5) Remove switch mounting-plate-to-bezel retaining screws (2).
 - (6) Remove switch-to-mounting-plate nut.
- For Installation, reverse Removal procedure.

Mirror Assembly Replacement (Fig. 2)**Removal**

- (1) Remove door trim panel and weathershield.
- (2) Reach inside door and disconnect mirror wiring at connector.
- (3) Remove mirror mounting bracket cover (1 screw) and slide up on mirror stem.
- (4) Remove mirror mounting bracket nuts (3).
- (5) Pull mirror loose from door, and feed wiring

harness out through hole in outer door panel.
For Installation, reverse Removal procedure.

**Fig. 2—Power Mirror Replacement**

ELECTRICAL WIRING DIAGRAMS

INDEX

	Page		Page
Charts		Locating a System or Component	2
Fusible Link Chart	3	Main Circuit Identification Codes	1
Wire Color Code Chart	2	Splice Locations	2
Master Wiring Diagrams	1	Electrical Wiring and Components Identification	
General Information	1	Index	9
Fusible Links	3	Electrical Wiring Diagram Wire Routing and	
Fusible Link Replacement	3	Component Location Index	30
Multiple Fusible Link Replacement	3	Splice Location Index	41
Single Fusible Link Replacement	3	Wiring Diagrams	52
		Symbols, Fuses and Connectors	3

MASTER WIRING DIAGRAMS

GENERAL INFORMATION

Master wiring diagrams contain the latest information available at time of publication. These diagrams contain various wires, wire routing, wire color codes, switches components, fuses, splices, connectors, connector cavities and other information except distributor secondary wiring (Figs. 1 and 2). Most main

circuits are identified by a main circuit identification code. Some codes will not apply to all vehicles. Secondary codes are not shown. See following main circuit codes:

Main Circuit Identification Codes

A1	Battery Positive Circuit.
A2	Battery Negative Circuit.
B	Back Up Lamp Circuit.
B3	Hazard Warning Flasher Feed.
C	Air Conditioning and Heater Circuits, Heated Rear Window, Radiator Fan Motor.
D	Emergency, Stop Lamp and Turn Signal Circuits, Lamp Outage, Brake Pad Sensor, Diagnostic Connector.
E	Instrument Panel Cluster, Switches and Illumination Circuits.
F	Power Assist Systems, Seats, Windows, and Door Locks.
G	Gauges, Warning Lamp Circuits and Voice Alert.
H	Horn Circuit.
J1	Ignition Switch Feed Circuit.
J2	Ignition System Run Circuit.
J3	Starter Relay to Ballast Resistor.
J10	Ignition Switch Accessory Feed.
K	Logic and Power Modules
L	Lighting Circuit Feed (Exterior Lamps).
M1	Lighting Circuit Feed (Interior Lamps).
M2	Lighting Circuit Ground (Interior Lamps).
P	Brake Checking Circuit.
Q2	Accessory Buss Bar Feed (Fuse Block).
Q3	Battery Buss Bar Feed (Feed).
R3	Alternator Circuit to Electronic Regulator (Field).
R6	Alternator Circuit Feed.
S	Starter Motor and Starter Relay Circuit.
T	Tachometer.
V	Windshield Wiper and Washer Circuit.
W	Power Window Circuit.
X	Grounds For Radio Speakers, Cigar Lighter, Lamps, Clock, Speed Control, Power Antenna, Power Amplifier, Power Windows, Power Mirrors, Deck Lid Release and Door Locks.
Y5	EFI or Turbo Ground.
Z1	Turbo Fuel Injectors EFI and Turbo Ignition Coil and Fuel Pump Motor.

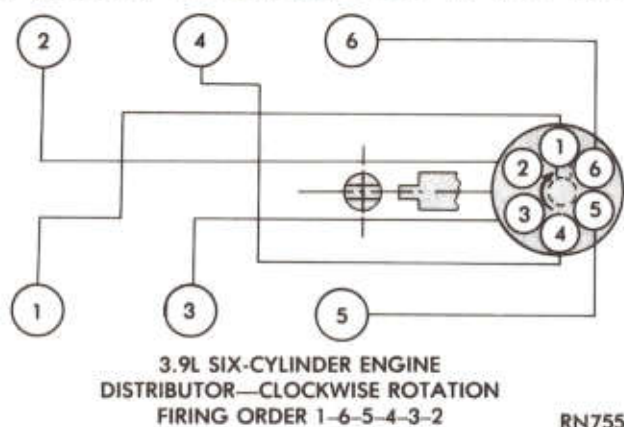


Fig. 1—Distributor Secondary Wiring 6-Cylinder 3.9L Engine

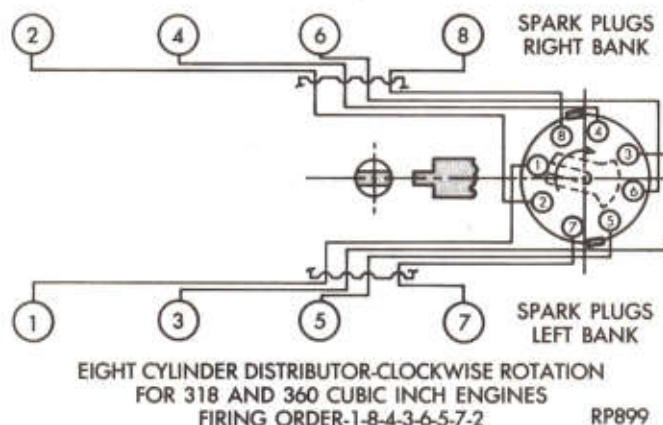


Fig. 2—Distributor Secondary Wiring 8-Cylinder 5.2L and 5.9L Engine

Each wire also contains a code (Fig. 3) which identifies main circuit identification, part of a main circuit,

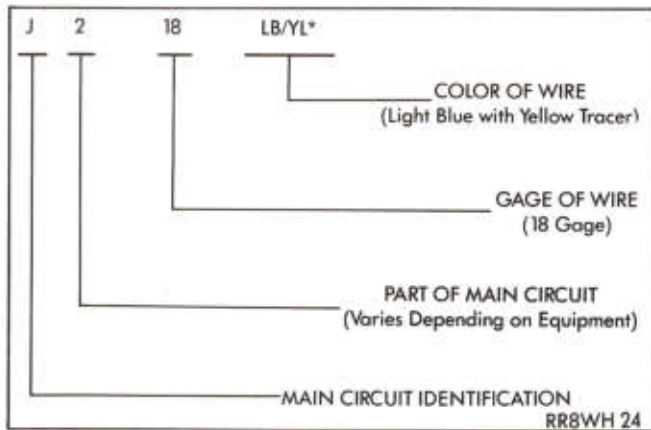


Fig. 3—Wire Color Code Identification

gauge of wire, color of wire which is shortened to two letters see wire color code chart, and if used a colored tracer identified by a slash (/) followed by two letters and an asterisk or an asterisk by itself.

WIRE COLOR CODE CHART					
Color Code	Color	Standard Tracer Color	Color Code	Color	Standard Tracer Code
BK	Black	WT	PK	Pink	BK or WH
BR	Brown	WT	RD	Red	WT
DB	Dark Blue	WT	TN	Tan	WT
DG	Dark Green	WT	VT	Violet	WT
GY	Gray	BK	WT	White	BK
LB	Light Blue	BK	YL	Yellow	BK
LG	Light Green	BK	*	With Tracer	
OR	Orange	BK			

Wiring harnesses that have substitute wires of a different color then called out on wiring diagrams should have an identifying tape with specified wire color code (Fig. 4).

LOCATING A SYSTEM OR COMPONENT

In order to locate a system or component use alphabetical index to determine diagram sheet number and turn to that sheet for wiring diagram.

Sheet numbers for each wiring diagram are located at lower right or left hand corner of each sheet. Page numbers at top of page do not apply to diagram sheets.

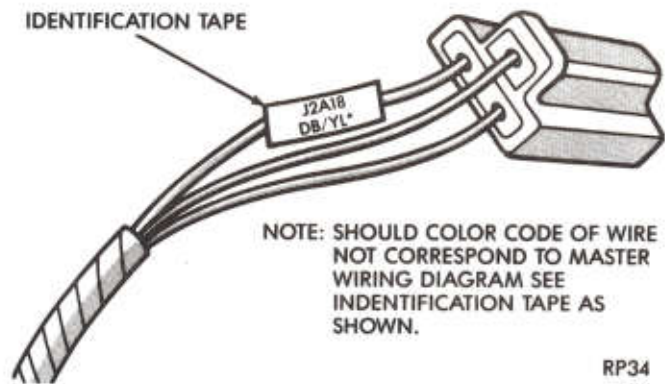


Fig. 4—Identification of Substitute Wiring Codes

SPICE LOCATIONS

Splice locations are indicated on master wiring diagrams by a diamond with splice circuit code within it (example 1). If there is more than one splice per circuit splice code a small box will be connected to the



Fig. 5—Wiring Splice Examples

diamond with the splice number in it (example 2) (Fig. 5).

In order to locate a particular splice determine splice number from master wiring diagram. Refer to pictorial splice index to find figure number then turn to that figure to determine splice location within a wiring harness (Fig. 6).

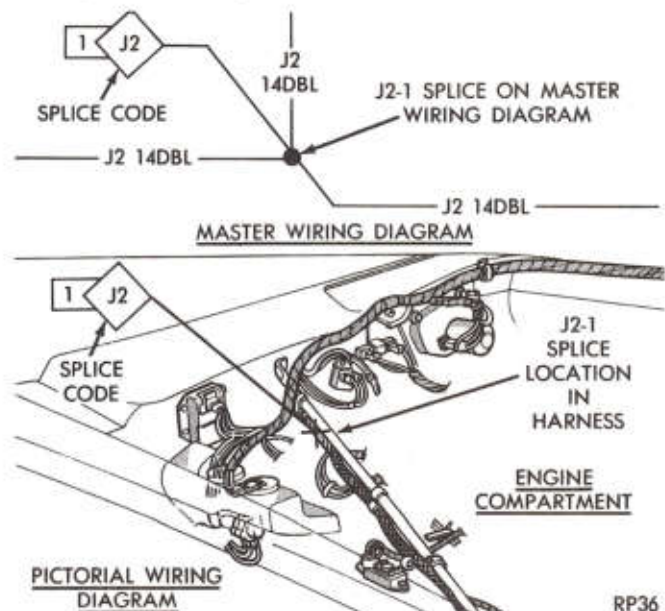


Fig. 6—Locating a Wiring Harness Splice

FUSIBLE LINK CHART		
Wire and Gauge	Color Code	Color
12 Ga.	BK	Black
14 Ga.	RD	Red
16 Ga.	DB	Dark Blue
18 Ga.	GY	Gray
20 Ga.	OR	Orange

All connectors are viewed from terminal end unless otherwise specified.

FUSIBLE LINKS

Vehicle wiring harnesses are equipped with fusible links to protect against harness damage in event of a short in electrical system.

Fusible links are color coded as to wire gauge size. See fusible link chart.

FUSIBLE LINK REPLACEMENT

CAUTION: Do not replace blown fusible links with standard wire. Only fusible type wire with hypalon insulation can be used or damage to the electrical system will occur. Also make sure correct gauge of wiring is used. Refer to Master Wiring Diagrams for proper gauge size. Service Parts replacement fusible links are available.

(1) When a fusible link blows it is very important to find out why it blew. They are placed in vehicle electrical systems for protection against dead shorts to ground which can be caused by electrical component failure or various wiring failures. **Do not just replace fusible link to correct problem.**

(2) When replacing fusible links that are connected to the battery terminal of starter relay, they are to be serviced with the same type of pre-fabricated fusible link, available through the Parts Division.

All other fusible links are replaced with a piece of fusible link wire cut from bulk reels supplied through Parts Division. Care must be taken that the same gauge and color wire as the original fusible link be used (see Fusible Link Chart).

Multiple Fusible Link Replacement

- (1) Disconnect negative battery cable.
- (2) Cut off any remaining portion of blown fusible link flush with multiple connection insulator, taking care not to cut into other fusible links.
- (3) Remove 1 inch of insulation from main harness wire about 1 inch from multiple connection insulator.
- (4) Remove 1 inch of insulation from one end of new

fusible link and wrap it around main harness wire that was stripped.

(5) Heat splice with a high temperature soldering gun, apply rosin type solder until it flows freely, and remove soldering gun. **Do not use acid core solder** (Fig. 7).

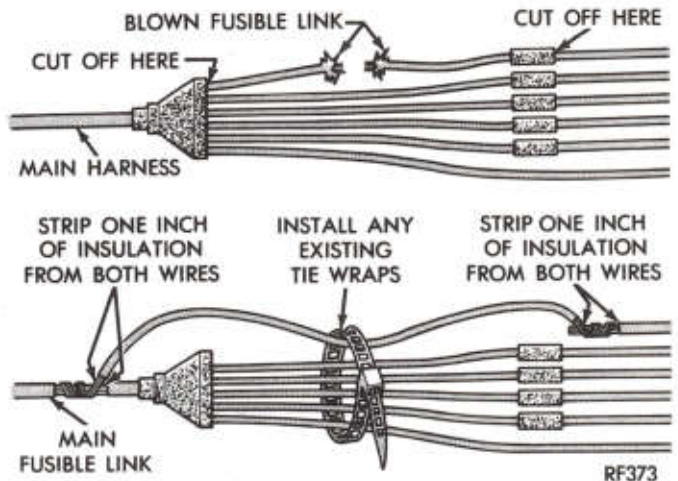


Fig. 7—Fusible Link Repair

(6) Allow to cool and wrap new splice with a minimum of 3 layers of suitable electrical tape.

Single Fusible Link Replacement

- (1) Disconnect negative battery cable.
- (2) Cut fusible link including connection insulator from main harness wire.
- (3) Remove 1 inch of insulation from both new fusible link and main harness wire and wrap together.
- (4) Heat splice with a high temperature soldering gun, apply rosin type solder until it flows freely and remove soldering gun. **Do not use acid core solder** (Fig. 7).
- (5) Allow to cool and wrap new splice with a minimum of 3 layers of suitable electrical tape.

SYMBOLS, FUSES AND CONNECTORS

Various symbols are used on wiring diagrams. These symbols can be identified by referring to symbol identification (Fig. 8).

Additional fuse and connector information may be found on (Figs. 9 thru 12).

CAUTION: When replacing a blown fuse, it is important to replace it with a fuse having the correct amperage rating. The use of a fuse with a rating other than indicated may result in a dangerous electrical overload. If a proper rated fuse continues to blow, it indicates a problem that should be corrected.

LEGEND OF SYMBOLS USED ON WIRING DIAGRAMS			
+	POSITIVE	→→	CONNECTOR
-	NEGATIVE	→	MALE CONNECTOR
	GROUND	↘	FEMALE CONNECTOR
	FUSE		MULTIPLE CONNECTOR
	CIRCUIT BREAKER	—↘	DENOTES WIRE CONTINUES ELSEWHERE
	CAPACITOR		SPLICE
Ω	OHMS		SPLICE IDENTIFICATION
	RESISTOR		OPTIONAL WIRING WITH WIRING WITHOUT
	VARIABLE RESISTOR		THERMAL ELEMENT (BI-METAL STRIP)
	SERIES RESISTOR		"Y" WINDINGS
	COIL	88:88	DIGITAL READOUT
	STEP UP COIL		SINGLE FILAMENT LAMP
	OPEN CONTACT		DUAL FILAMENT LAMP
	CLOSED CONTACT		L.E.D.-LIGHT EMITTING DIODE
	CLOSED SWITCH		THERMISTOR
	OPEN SWITCH		GAUGE
	CLOSED GANGED SWITCH		TIMER
	OPEN GANGED SWITCH		MOTOR
	TWO POLE SINGLE THROW SWITCH		ARMATURE AND BRUSHES
	PRESSURE SWITCH		DENOTES WIRE GOES THROUGH GROMMET
	SOLENOID SWITCH		DENOTES WIRE GOES THROUGH 40 WAY DISCONNECT
	MERCURY SWITCH		DENOTES WIRE GOES THROUGH 25 WAY STEERING COLUMN CONNECTOR
	DIODE OR RECTIFIER		DENOTES WIRE GOES THROUGH 25 WAY INSTRUMENT PANEL CONNECTOR
	BY-DIRECTIONAL ZENER DIODE		

RH983A

Fig. 8—Symbol Identification

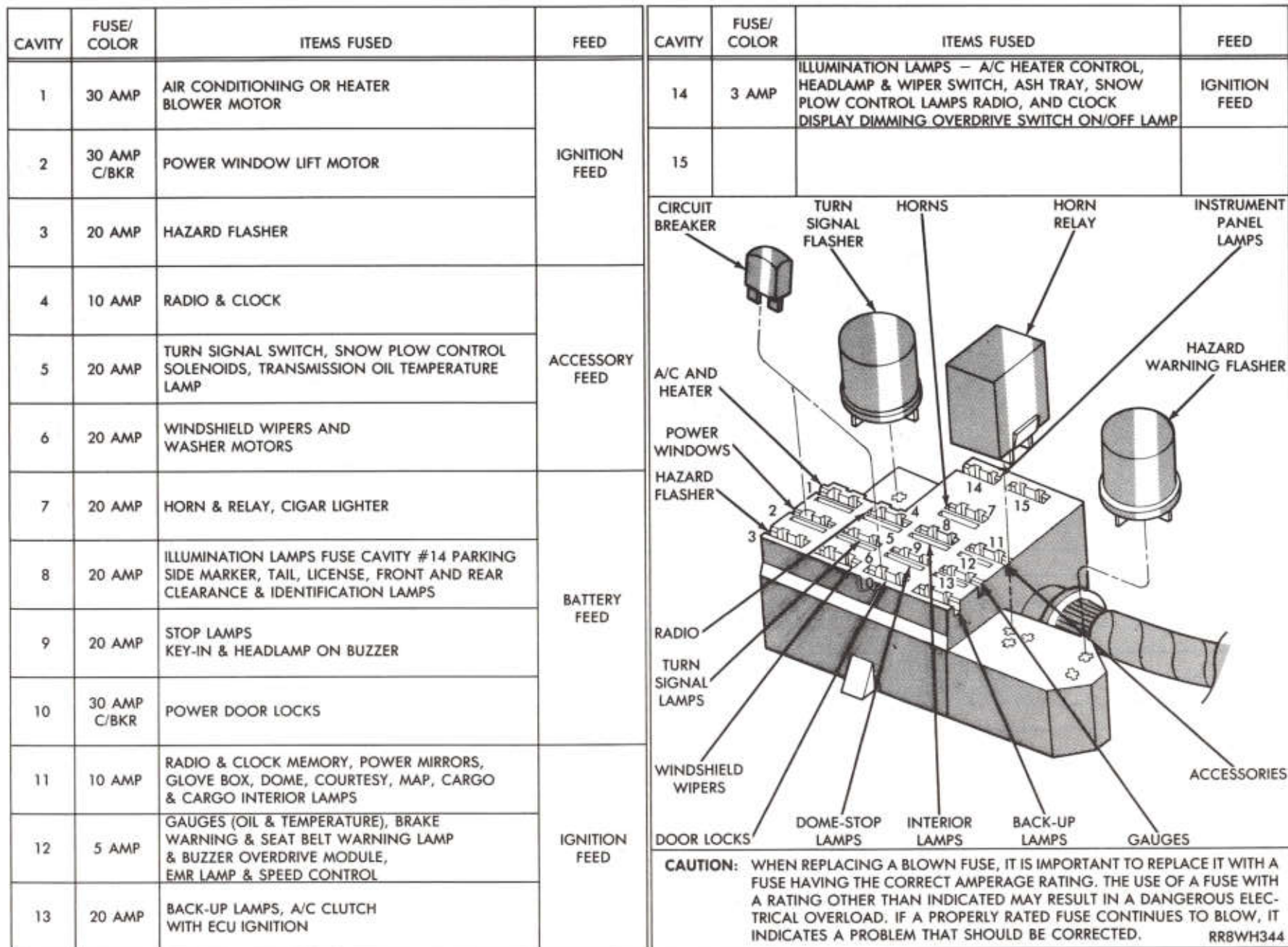
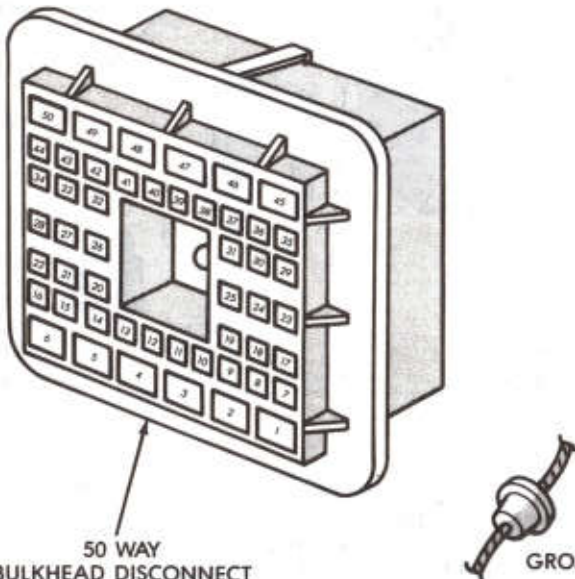


Fig. 9—Fuse Block and Relay Bank

CAV.	WIRE COLOR	DESCRIPTION	CAV.	WIRE COLOR	DESCRIPTION
1	RD/WT*	BATTERY FEED	36	DB	WINDSHIELD WIPER SWITCH
2	DG	AC AND HEATER BLOWER MOTOR	37	DB/OR*	A/C CLUTCH
3			38	BK/PK*	CHECK ENGINE LAMP
4			39	DB/YL*	FUEL TANK SENDING UNIT
5	VT/WT*	HEADLAMPS LOW BEAM	40	LG/BR*	4-WHEEL DRIVE SWITCH
6	RD/OR*	HEADLAMPS HIGH BEAM	41		
7	DB/RD*	SPEED CONTROL	42		
8	BR/RD*	SPEED CONTROL	43	RD	AMMETER
9	WT/RD*	SPEED CONTROL	44	BK	AMMETER
10			45	BR/WT*	WINDSHIELD WIPER LOW SPEED
11			46	RD/YL*	WINDSHIELD WIPER HIGH SPEED
12	OR/WT*	OVERDRIVE SWITCH	47	DB	IGNITION RUN & START (PIN 1)
13	OR/DB*	OVERDRIVE SOLENOID	48	BK/RD*	BATTERY FEED
14			49	RD	IGNITION SWITCH (PIN B1)
15	DG/YL*	LEFT REAR TURN SIGNAL LAMP	50	PK/BK*	IGNITION SWITCH (PIN B3)
16	BR/YL*	RIGHT REAR TURN SIGNAL LAMP	GROMMET		
17	VT/YL*	TEMPERATURE SENDING UNIT OR SWITCH	#1	SNOW PLOW	EXTRA EQUIPMENT
18	GY	OIL PRESSURE LAMP SWITCH			
19	GY/YL*	OIL PRESSURE GAUGE SENDING UNIT			
20					
21	LG	LEFT FRONT TURN SIGNAL LAMP			
22	TN	RIGHT FRONT TURN SIGNAL LAMP			
23	PK/WT*	HAZARD FLASHER			
24					
25					
26	BK/YL*	PARKING LAMPS			
27	WT	BACK-UP LAMP FEED			
28					
29	BR	WINDSHIELD WASHER MOTOR			
30					
31	YL	IGNITION SWITCH START (PIN 5)			
32	DG/RD*	HORNS			
33					
34	GY/BK*	BRAKE WARNING LAMP	WIRE COLOR CODES		
35	DG	WINDSHIELD WIPER SWITCH	BK BLACK		
			BR BROWN		
			DB DARK BLUE		
			DG DARK GREEN		
			GY GRAY		
			LB LIGHT BLUE		
			LG LIGHT GREEN		
			OR ORANGE		
			PK PINK		
			RD RED		
			TN TAN		
			VT VIOLET		
			WT WHITE		
			YL YELLOW		
			* WITH TRACER		

RR8WH345

RR8WH345

Fig. 10—50-Way Bulkhead Disconnect

CAV	WIRE COLOR	DESCRIPTION	CAV	WIRE COLOR	DESCRIPTION
1	DG/RD*	MAP SENSOR	37		
2			38	OR/WT*	OVERDRIVE TRANSMISSION LOCK-OUT SWITCH
3	TN/WT*	COOLANT SENSOR*	39	BK/OR*	AIR SWITCHING SOLENOID
4	BK/LB*	SENSOR RETURN	40	GY/YL*	EGR SOLENOID
5	BK/WT*	SIGNAL GROUND	41	RD	DIRECT BATTERY
6			42		
7			43		
8			44		
9			45	BR	A/C CLUTCH INPUT
10	DG/BK*	Z1 INPUT	46		
11			47	GY/BK*	REFERENCE PICKUP
12	DB/WT*	FJ2	48	WT/OR*	VEHICLE DISTANCE PICKUP
13	VT/WT*	5 VOLT SUPPLY	49		
14	DG/OR*	ALTERNATOR FIELD CONTROL	50		
15	LB/RD*	POWER GROUND	51	PK	SCI TRANSMIT
16	LB/RD*	POWER GROUND	52	OR	9 VOLT INPUT
17	BR/WT*	AIS-1	53		
18			54	PK/BK*	PURGE SOLENOID
19	GY/RD*	AIS-3	55	OR/BK*	LOCK-UP TORQUE CONVERTER OR SHIFT IND LAMP — MANUAL TRANS
20			56	DB/OR*	A/C WIDE OPEN THROTTLE CLUTCH CUT-OUT
21			57		
22	OR/DB*	THROTTLE POSITION SENSOR	58	DB/YL*	AUTO SHUT DOWN RELAY
23	BK/DG*	OXYGEN SENSOR	59	BK/PK*	CHECK ENGINE LAMP
24			60		
25			WIRE COLOR CODES		
26	VT	CLOSED THROTTLE SWITCH	BK	BLACK	LG
27			BR	BROWN	OR
28			DB	DARK BLUE	PK
29	WT/PK*	BRAKE SWITCH	DG	DARK GREEN	RD
30	BR/YL*	PARK/NEUTRAL SWITCH	GY	GRAY	TN
31	LG	SCI RECEIVE	LB	LIGHT BLUE	VT
32	GY/WT*	INJECTOR CONTROL 2	LG	LIGHT GREEN	WT
33	VT/YL*	INJECTOR CONTROL 1	OR	ORANGE	YL
34	YL	DWELL CONTROL	PK	PINK	*
35			RD	RED	WITH TRACER
36			TN	TAN	

CONNECTOR
TERMINAL SIDE
SHOWN

RR8WH346

Fig.11—60-Way Single Module Engine Connector 3.9L and 5.2L Engine

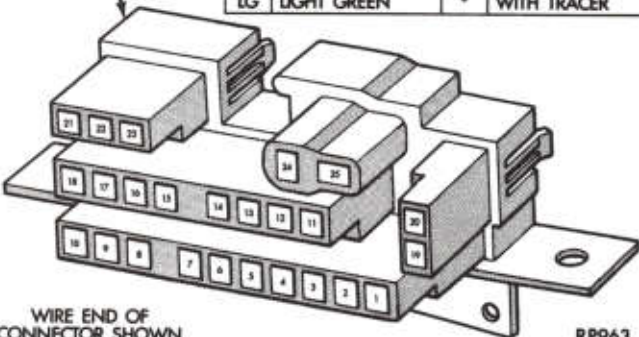
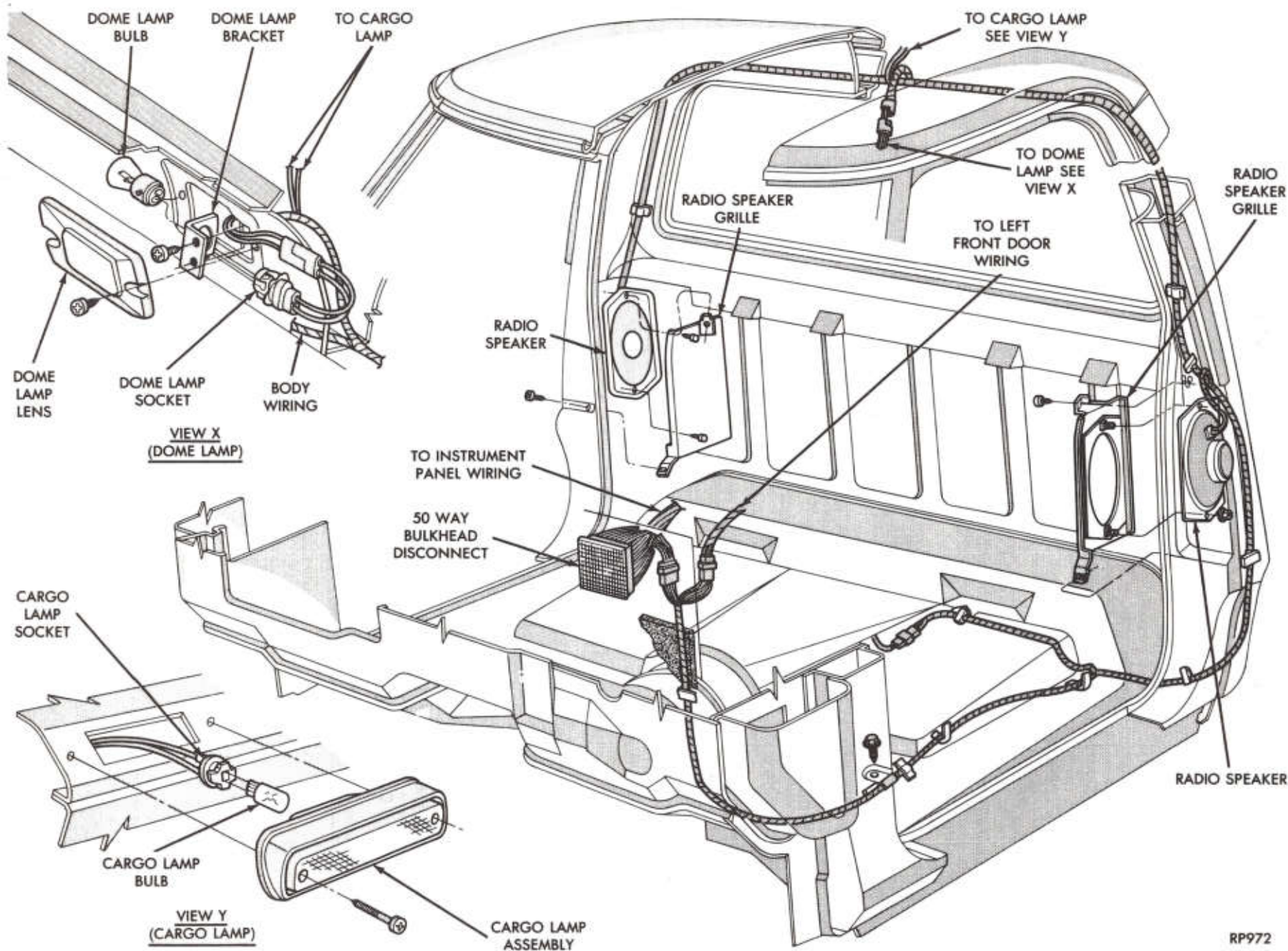
CAV	WIRE COLOR	DESCRIPTION	CAV	WIRE COLOR	DESCRIPTION																																
1			20	BK/LB*	GROUND FROM LEFT FRONT DOOR JAMB SWITCH																																
2	BK BK	HORN & KEY-IN LAMP GROUND (STANDARD COLUMN)	21																																		
3	BK/RD*	GROUND FROM HORN SWITCH	22																																		
4	LG	LEFT FRONT TURN SIGNAL	23																																		
5	TN*	RIGHT FRONT TURN SIGNAL	24	YL/RD*	KEY-IN LAMP FEED (W/OPTIONS)																																
6	PK/BK*	FEED FROM HAZARD FLASHER	25	BK	KEY-IN LAMP GROUND WIRE (TILT COLUMN)																																
7	RD/BK*	FEED FROM TURN SIGNAL FLASHER	25 WAY CONNECTOR <table><tr><th colspan="2">WIRE COLOR CODES</th><th>OR</th><th>ORANGE</th></tr><tr><td>BK</td><td>BLACK</td><td>PK</td><td>PINK</td></tr><tr><td>BR</td><td>BROWN</td><td>RD</td><td>RED</td></tr><tr><td>DB</td><td>DARK BLUE</td><td>TN</td><td>TAN</td></tr><tr><td>DG</td><td>DARK GREEN</td><td>VT</td><td>VIOLET</td></tr><tr><td>GY</td><td>GRAY</td><td>WT</td><td>WHITE</td></tr><tr><td>LB</td><td>LIGHT BLUE</td><td>YL</td><td>YELLOW</td></tr><tr><td>LG</td><td>LIGHT GREEN</td><td>*</td><td>WITH TRACER</td></tr></table> 			WIRE COLOR CODES		OR	ORANGE	BK	BLACK	PK	PINK	BR	BROWN	RD	RED	DB	DARK BLUE	TN	TAN	DG	DARK GREEN	VT	VIOLET	GY	GRAY	WT	WHITE	LB	LIGHT BLUE	YL	YELLOW	LG	LIGHT GREEN	*	WITH TRACER
WIRE COLOR CODES		OR				ORANGE																															
BK	BLACK	PK				PINK																															
BR	BROWN	RD				RED																															
DB	DARK BLUE	TN				TAN																															
DG	DARK GREEN	VT	VIOLET																																		
GY	GRAY	WT	WHITE																																		
LB	LIGHT BLUE	YL	YELLOW																																		
LG	LIGHT GREEN	*	WITH TRACER																																		
8	DG/YL*	LEFT REAR TURN SIGNAL																																			
9	BR/YL*	RIGHT REAR TURN SIGNAL																																			
10	WT/TN*	FEED FROM BRAKE SWITCH																																			
11																																					
12	BR*	WINDSHIELD WIPER LOW SPEED																																			
13	RD/YL*	WINDSHIELD WIPER HIGH SPEED																																			
14	DG	WINDSHIELD WIPER MOTOR PARK RETURN & INTERMITTENT WIPE SIGNAL																																			
15	DB DB	WINDSHIELD WIPER SWITCH FEED & MOTOR PARK FEED																																			
16	BR	WINDSHIELD WASHER MOTOR																																			
17	BK BK	INTERMITTENT WIPE SWITCH GROUND																																			
18	BK/LG*	INTERMITTENT WIPE MODULE GROUND																																			
19	LB	KEY-IN BUZZER																																			

Fig. 12—25-Way Instrument Panel to Body Connector

ELECTRICAL WIRING AND COMPONENT IDENTIFICATION INDEX	
CAPTION	FIG. NUMBER
Cab Wiring and Component Identification	1
Body Wiring and Component Identification	2
Tail, Stop and Turn Signal Wiring and Component Identification	3
Door Wiring and Component Identification	4
Frame Wiring and Component Identification	5
License Lamp Wiring and Component Identification	6
Dash Panel Wiring and Component Identification	7
Instrument Panel Wiring and Component Identification	8
Speed Control, Stop Lamp, and Park Brake Wiring and Component Identification	9
Snow Plow Control Wiring and Component Identification	10
Hatchgate Ajar Wiring and Component Identification	11
Heater and A/C Wiring and Component Identification	12
Steering Column Wiring and Component Identification	13
Cowl Wiring and Component Identification	14
Engine Compartment Wiring and Component Identification With ECU Ignition	15
Engine Compartment Wiring and Component Identification With EFI Ignition	16
Starter Motor Wiring and Component Identification	17
Transmission Wiring and Component Identification	18
Four Wheel Drive Wiring and Component Identification	19
Headlamp Component Identification	20
Snow Plow Wiring and Component Identification	21
Engine Wiring Component Identification 3.9L and 5.2L TBI Engine	22
Engine Wiring and Component Identification 5.9L 4BBL 360 CID Engine With ECU Ignition	23
Engine Wiring and Component Identification 5.9L 4BBL 360 CID H.D. Engine With ECU Ignition	24



RP972

Fig. 1—Cab Wiring and Component Identification

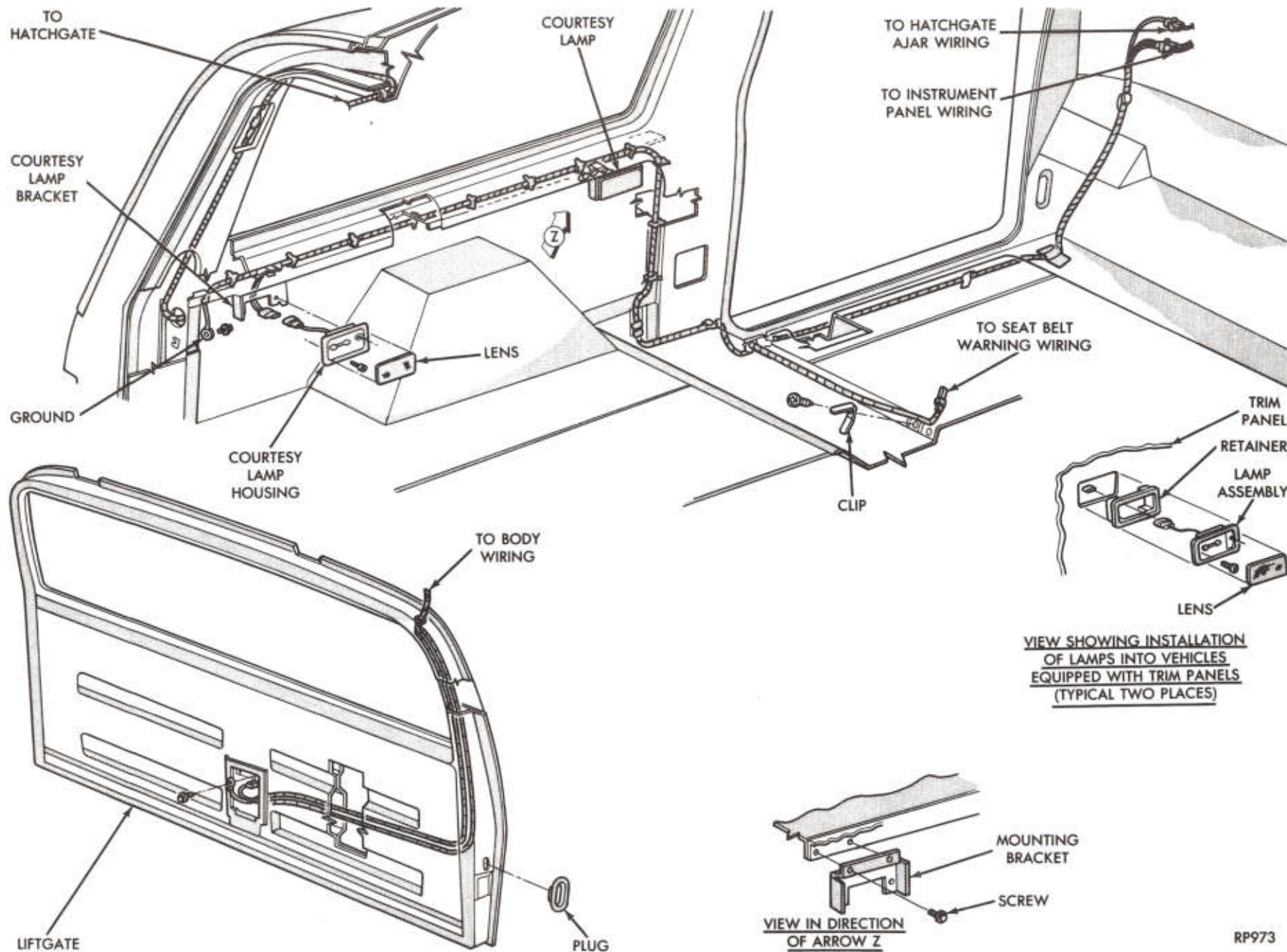


Fig. 2—Body Wiring and Component Identification

RP973

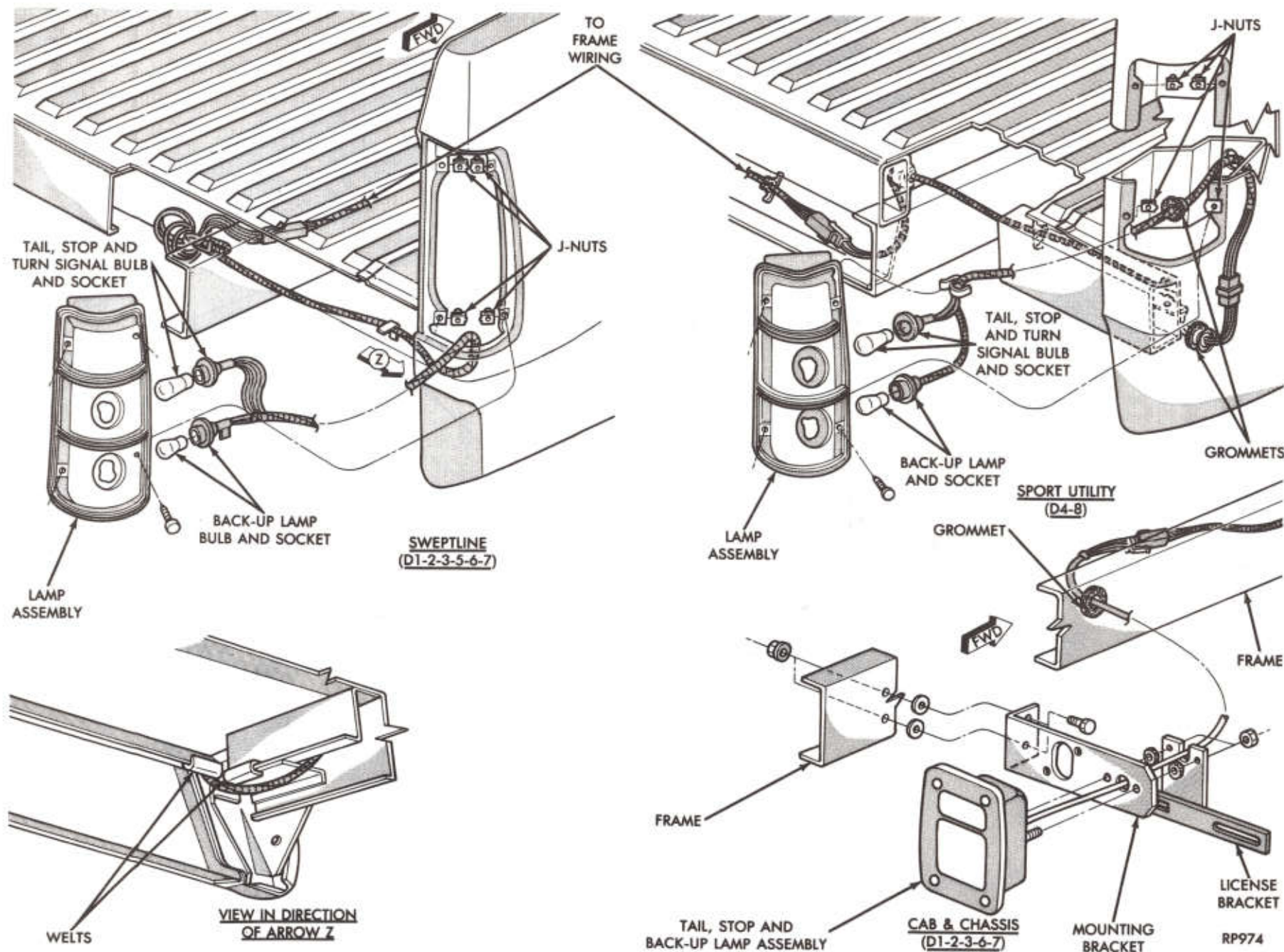


Fig. 3—Tail, Stop, and Turn Signal Lamp Wiring and Component Identification

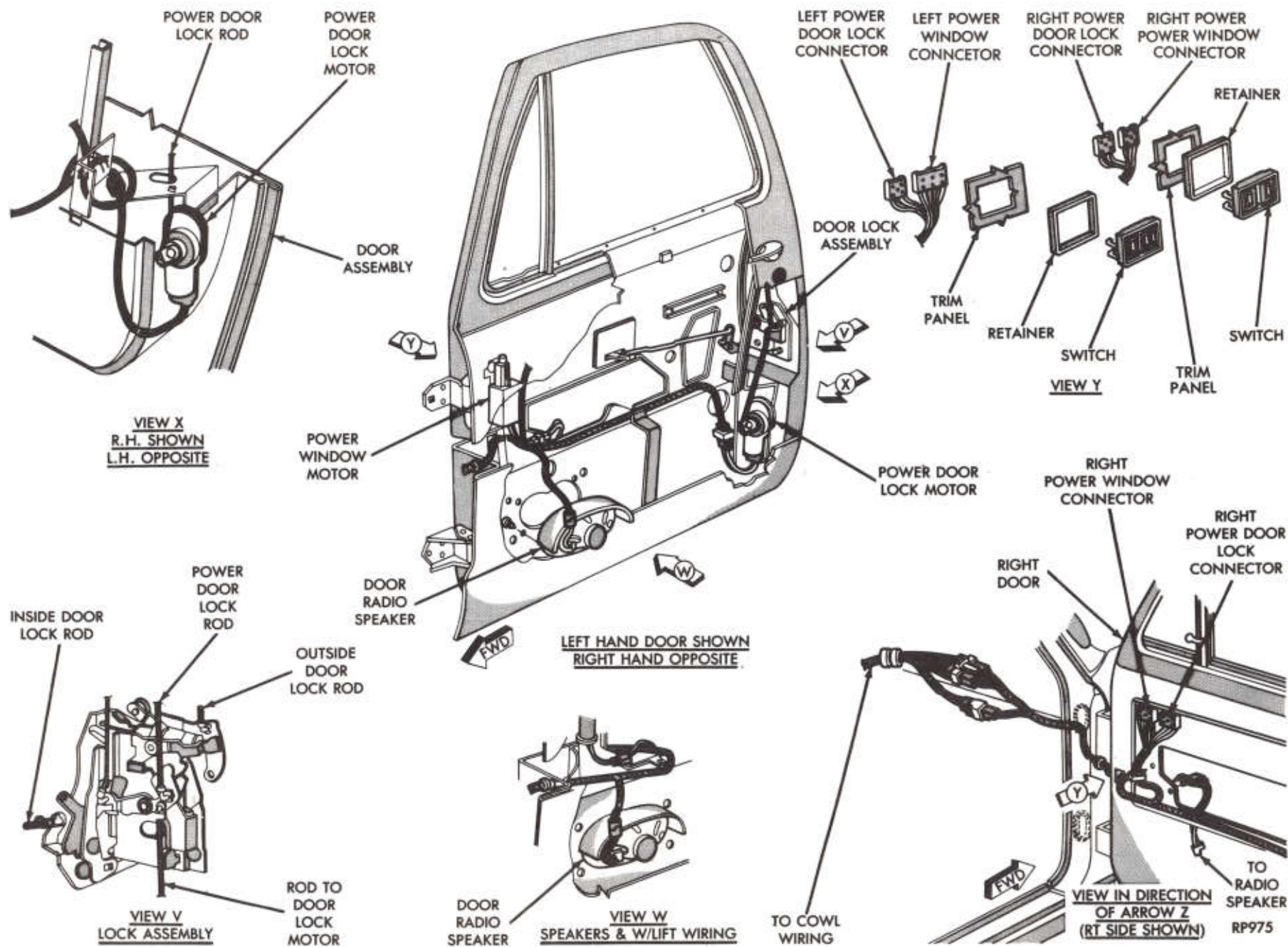


Fig. 4—Door Wiring and Component Identification

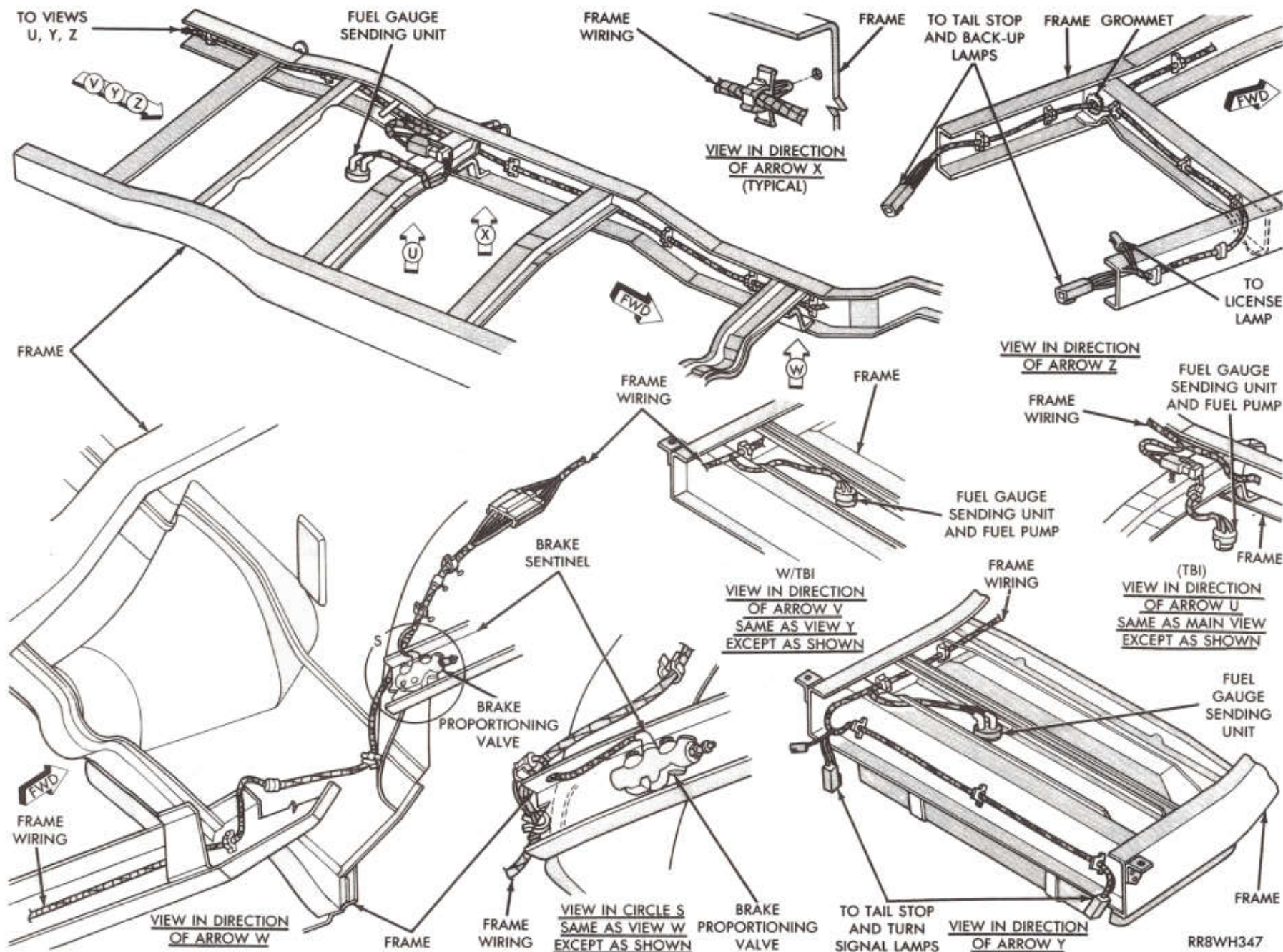


Fig. 5—Frame Wiring and Component Identification

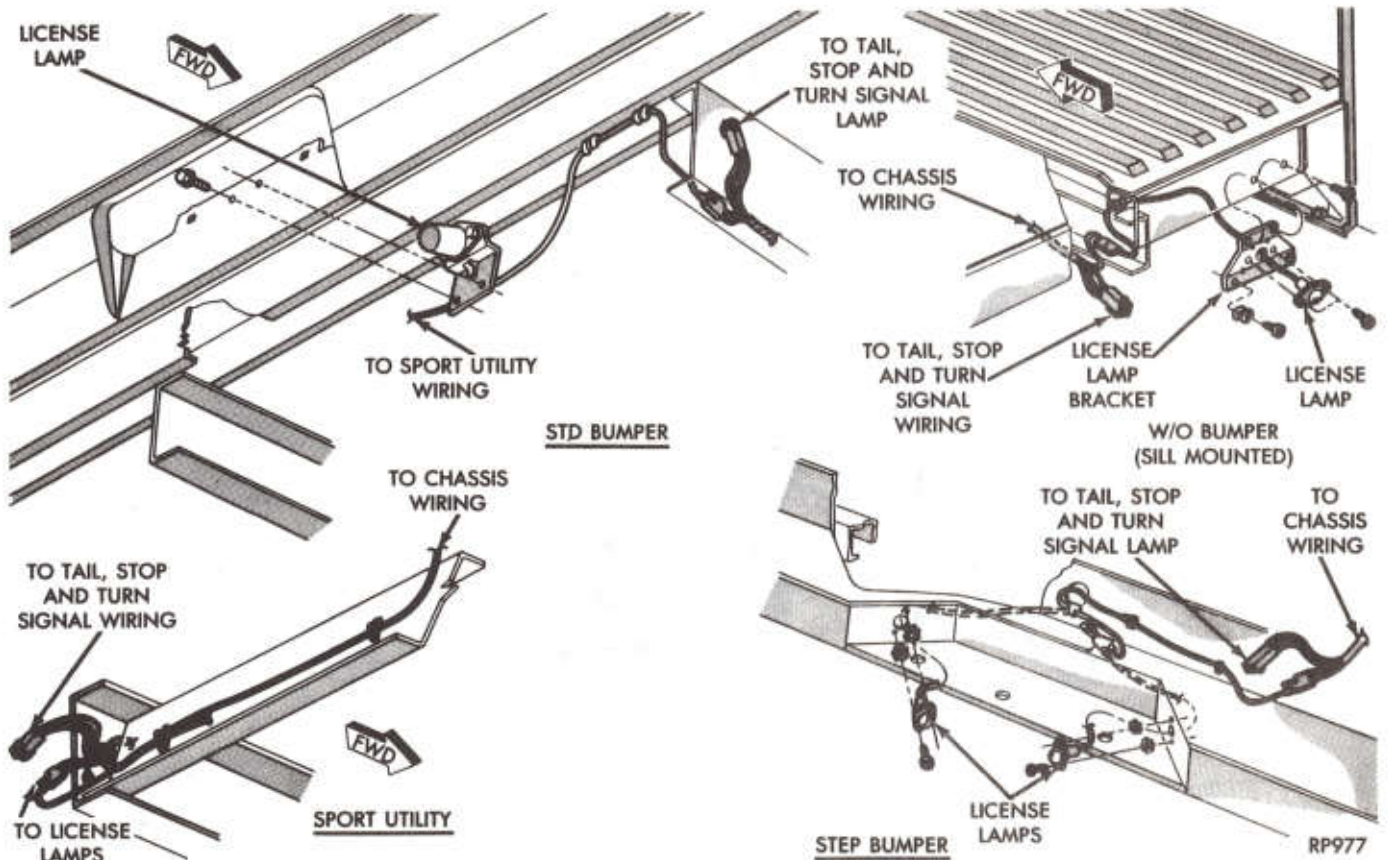


Fig. 6—License Lamp Wiring and Component Identification

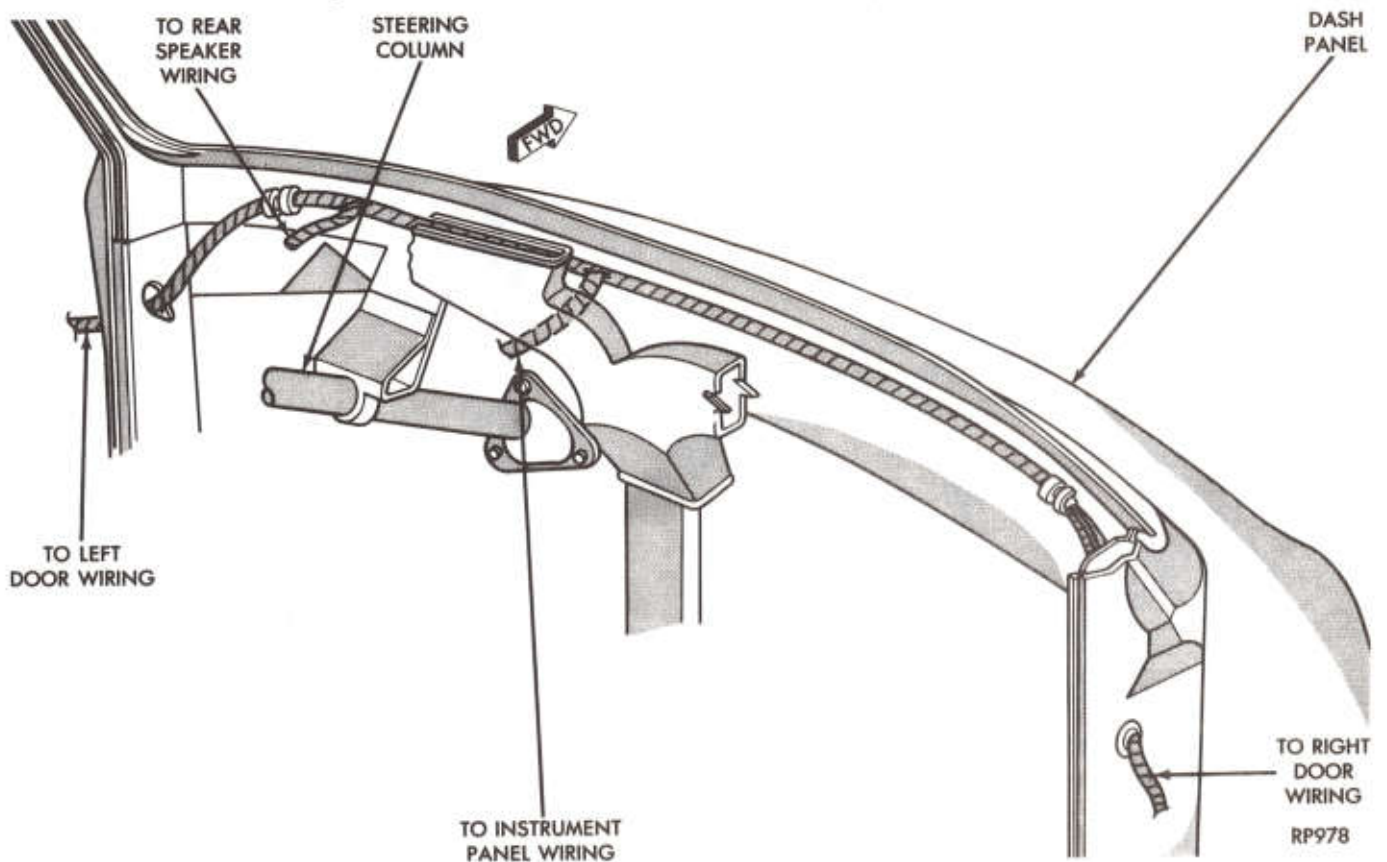


Fig. 7—Dash Panel Wiring and Component Identification

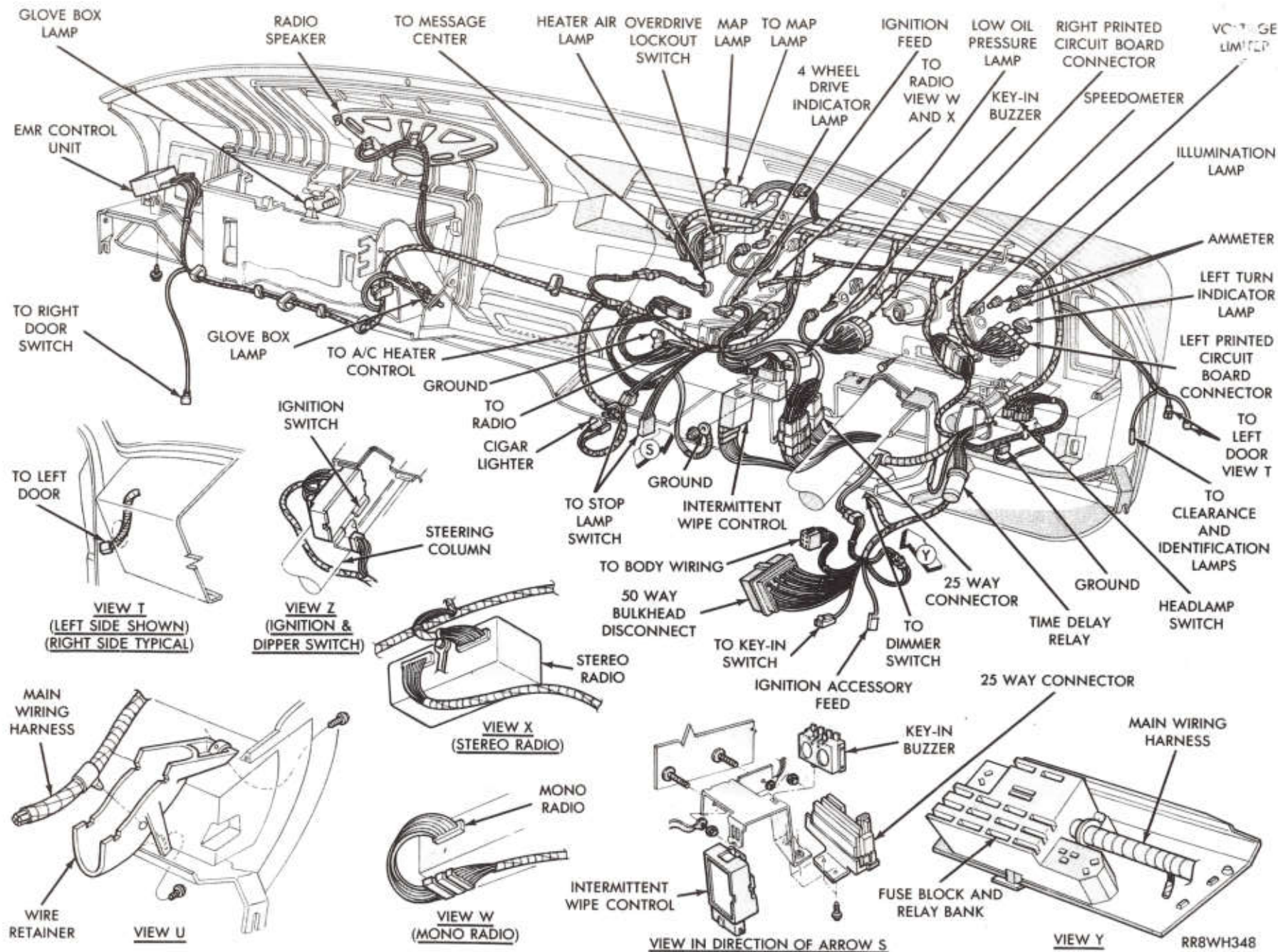


Fig. 8—Instrument Panel Wiring and Component Identification

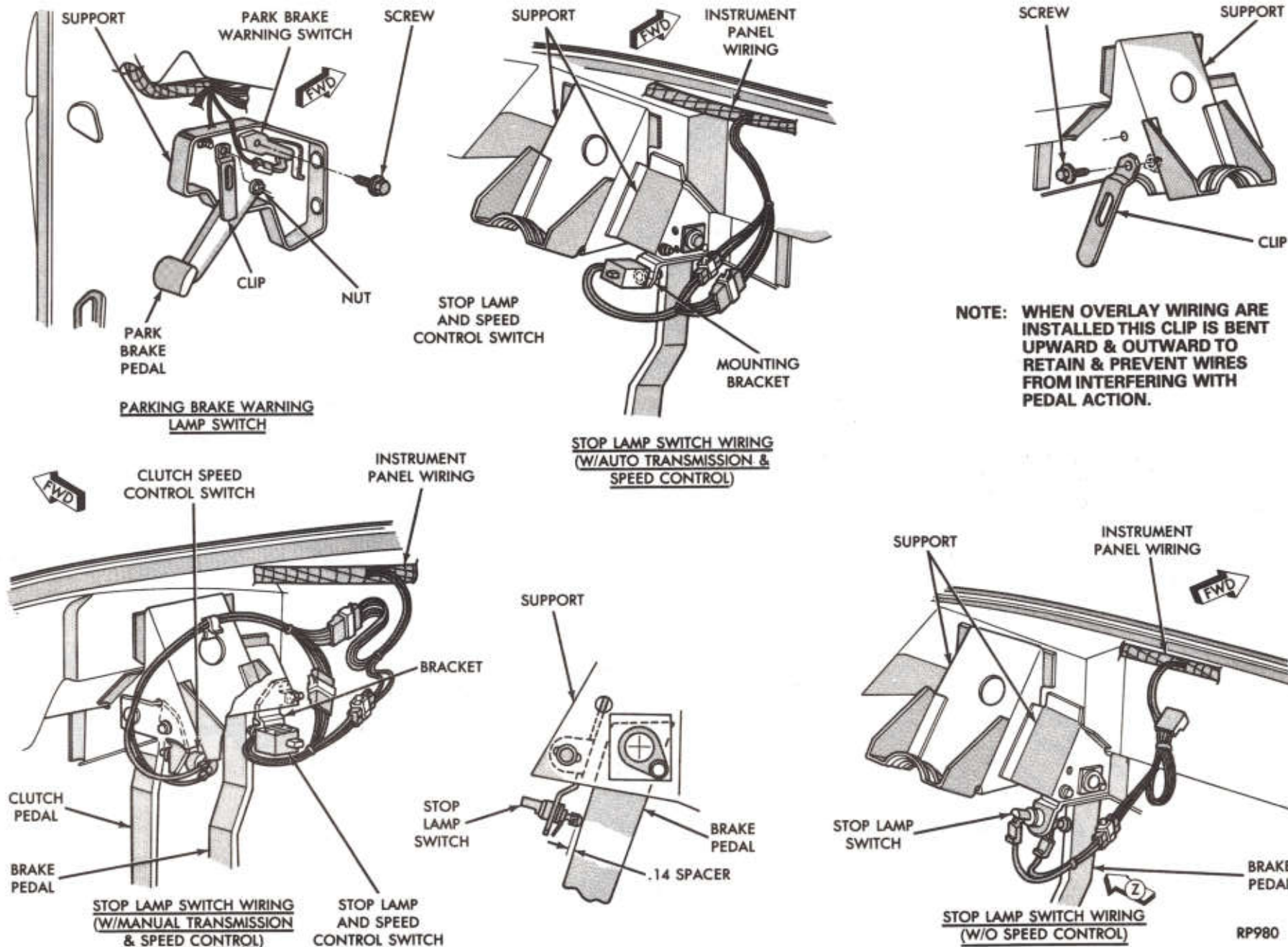


Fig. 9—Speed Control, Stop Lamp, and Park Brake Wiring and Component Identification

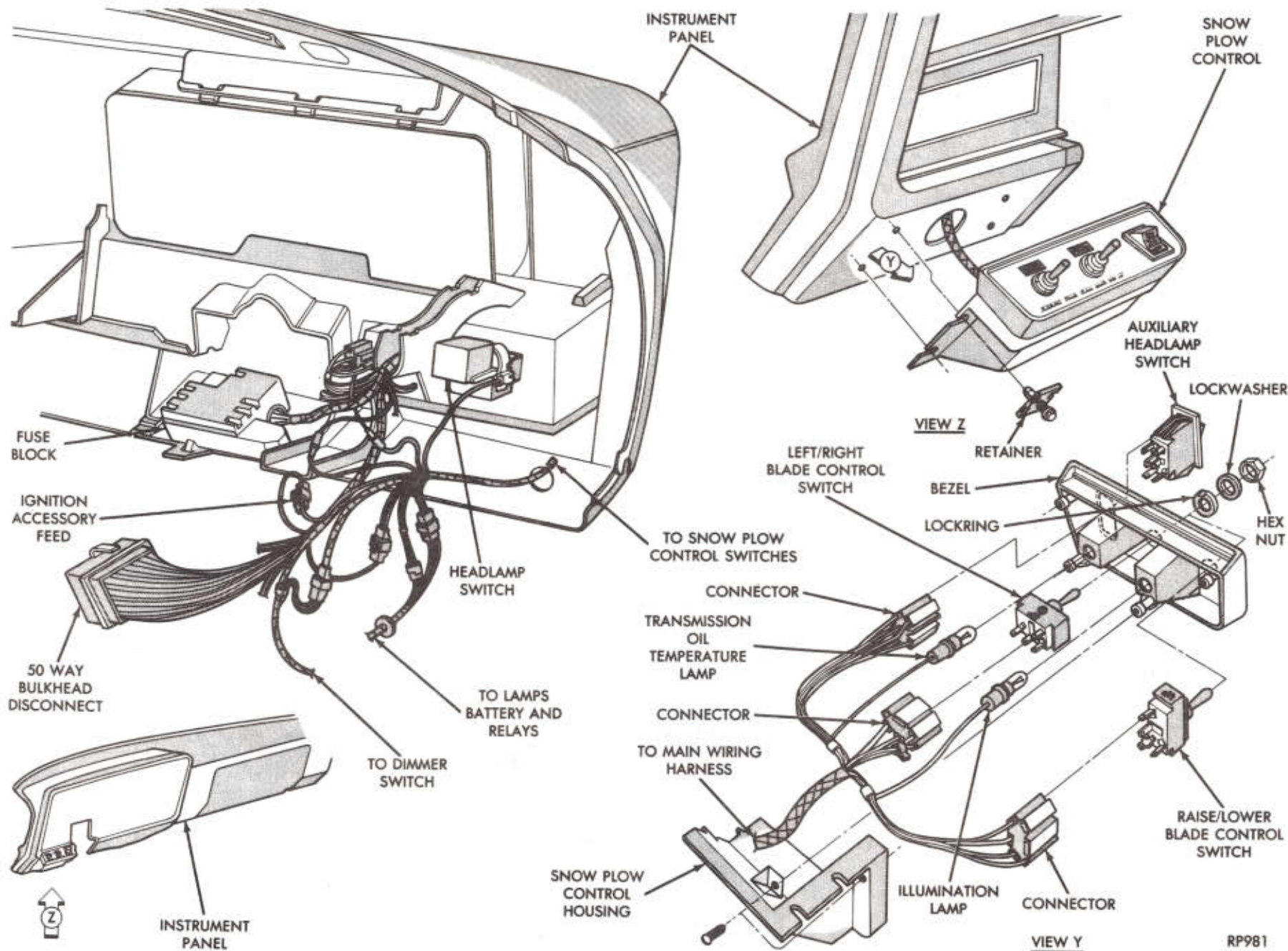


Fig. 10—Snow Plow Control Wiring and Component Identification

RP981

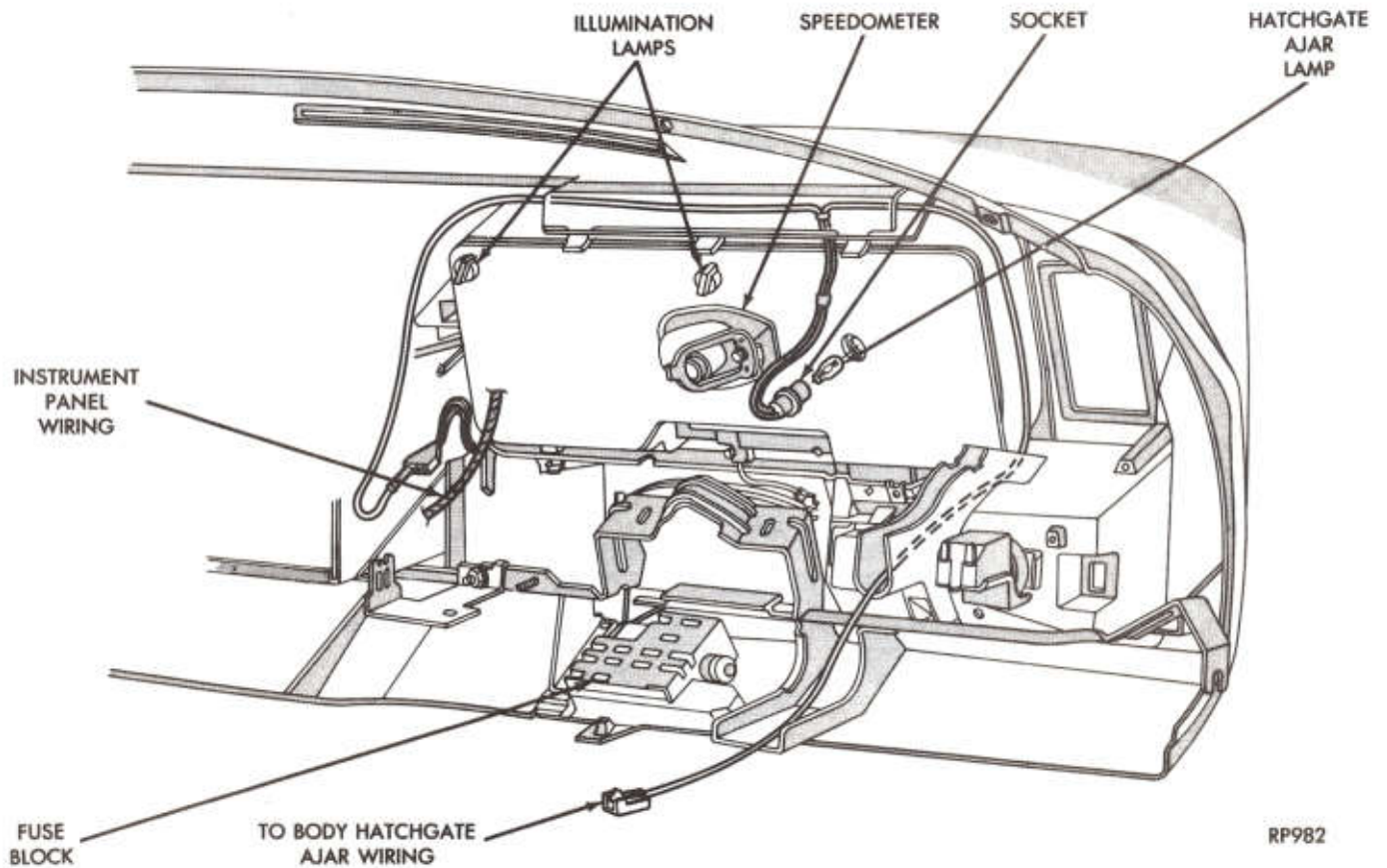


Fig. 11—Hatchgate Ajar Wiring and Component Identification

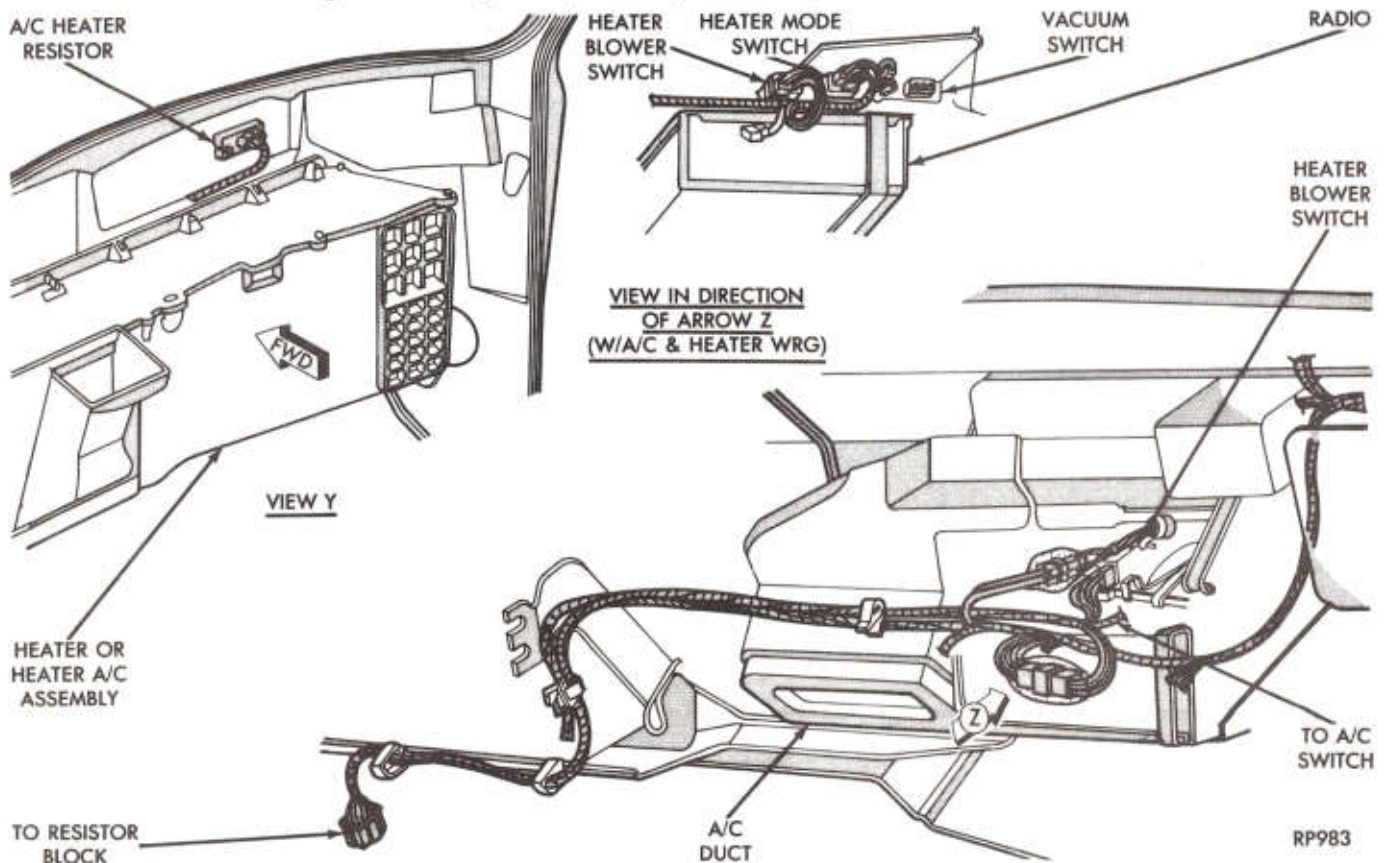


Fig. 12—Heater and A/C Wiring and Component Identification

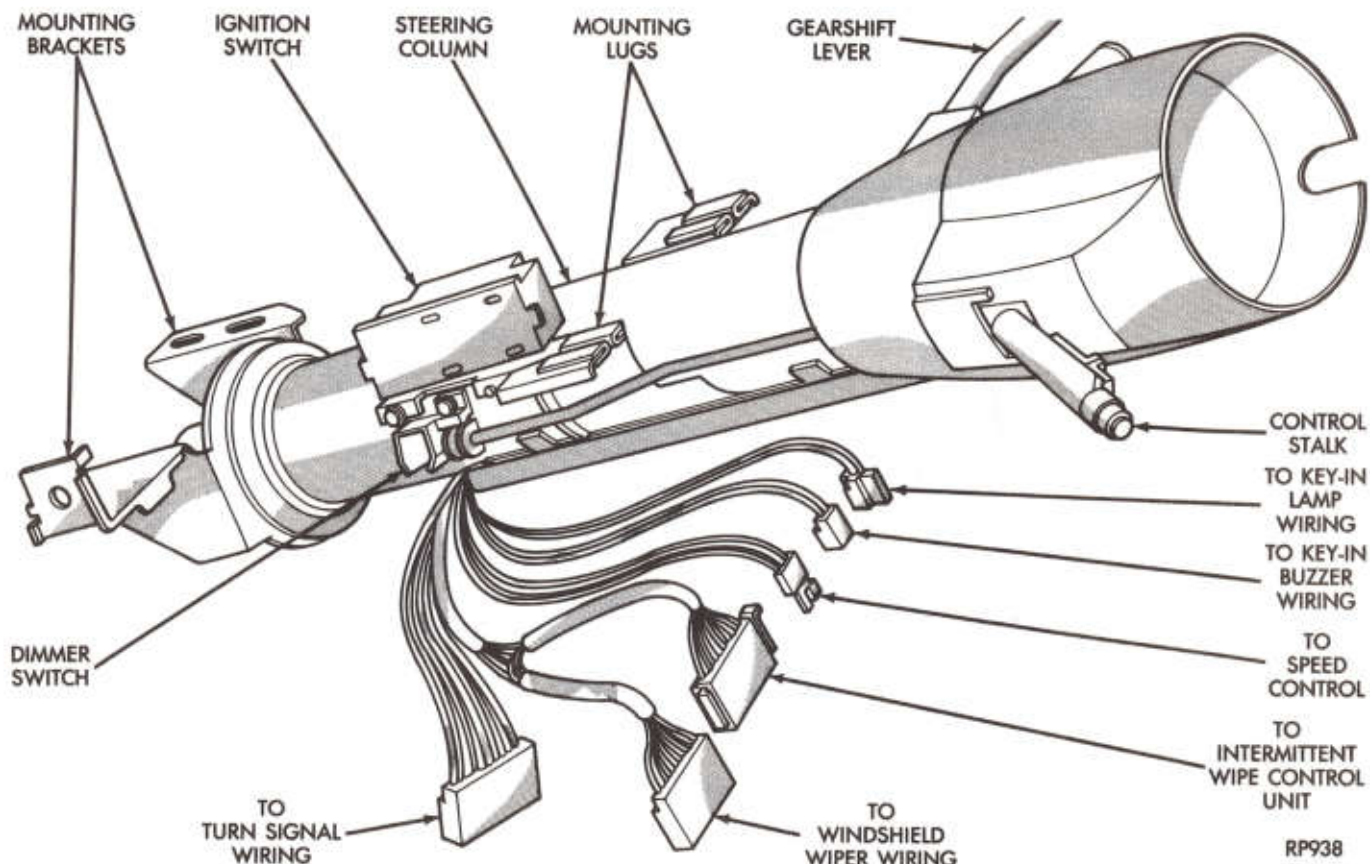


Fig. 13—Steering Column Wiring and Component Identification

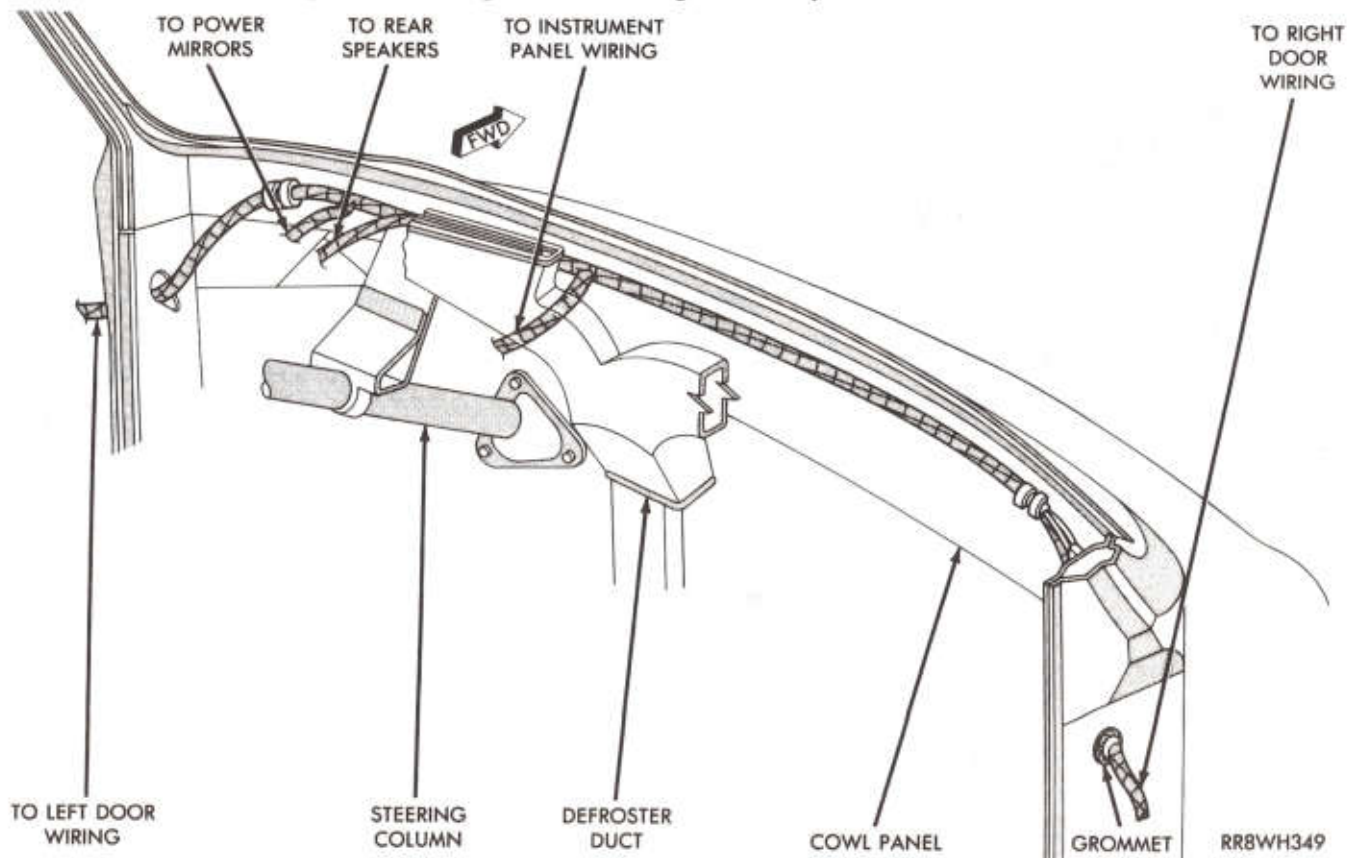


Fig. 14—Cowl Wiring and Component Identification

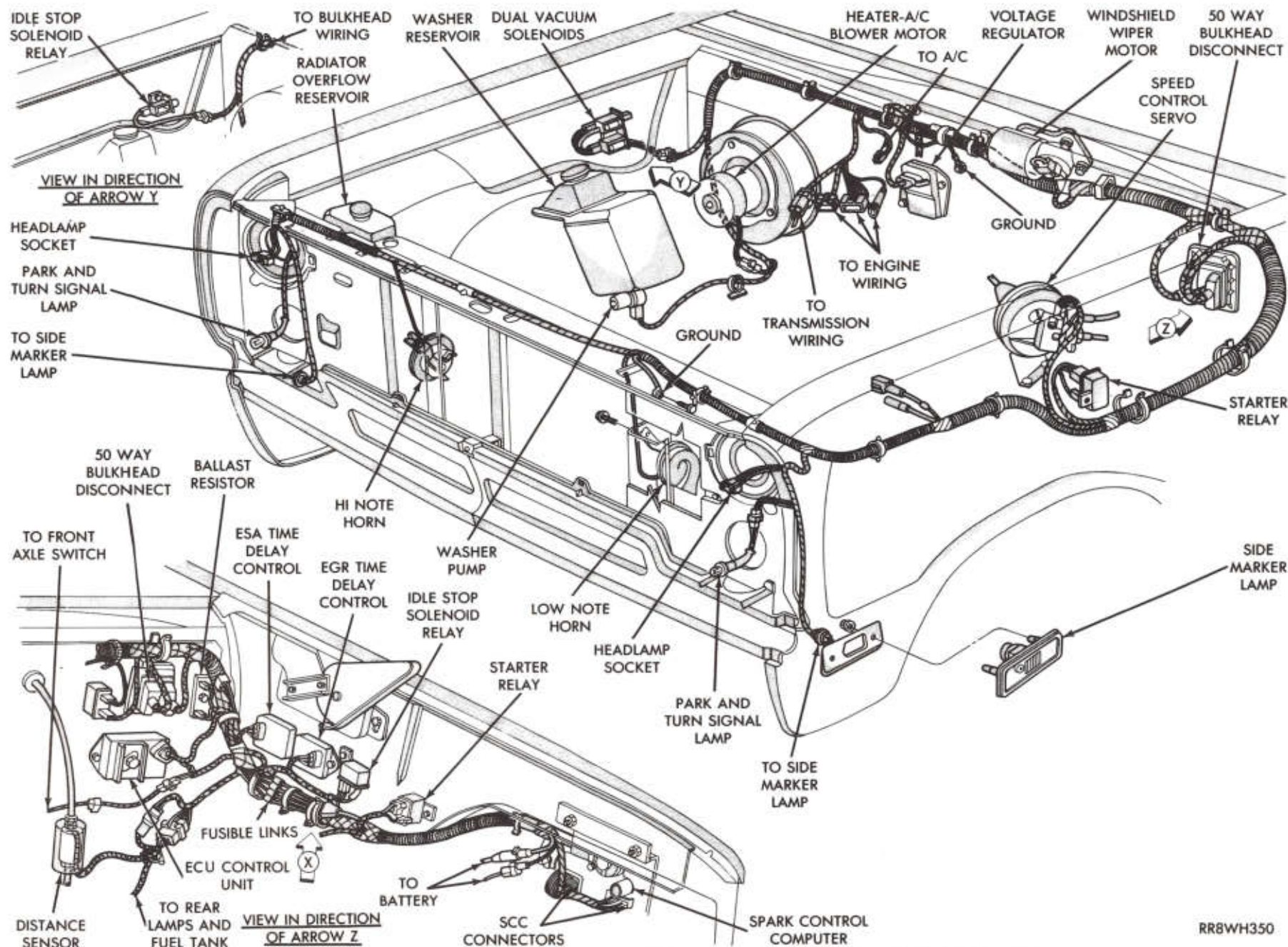


Fig. 15—Engine Compartment Wiring and Component Identification With ECU Ignition

RR8WH350

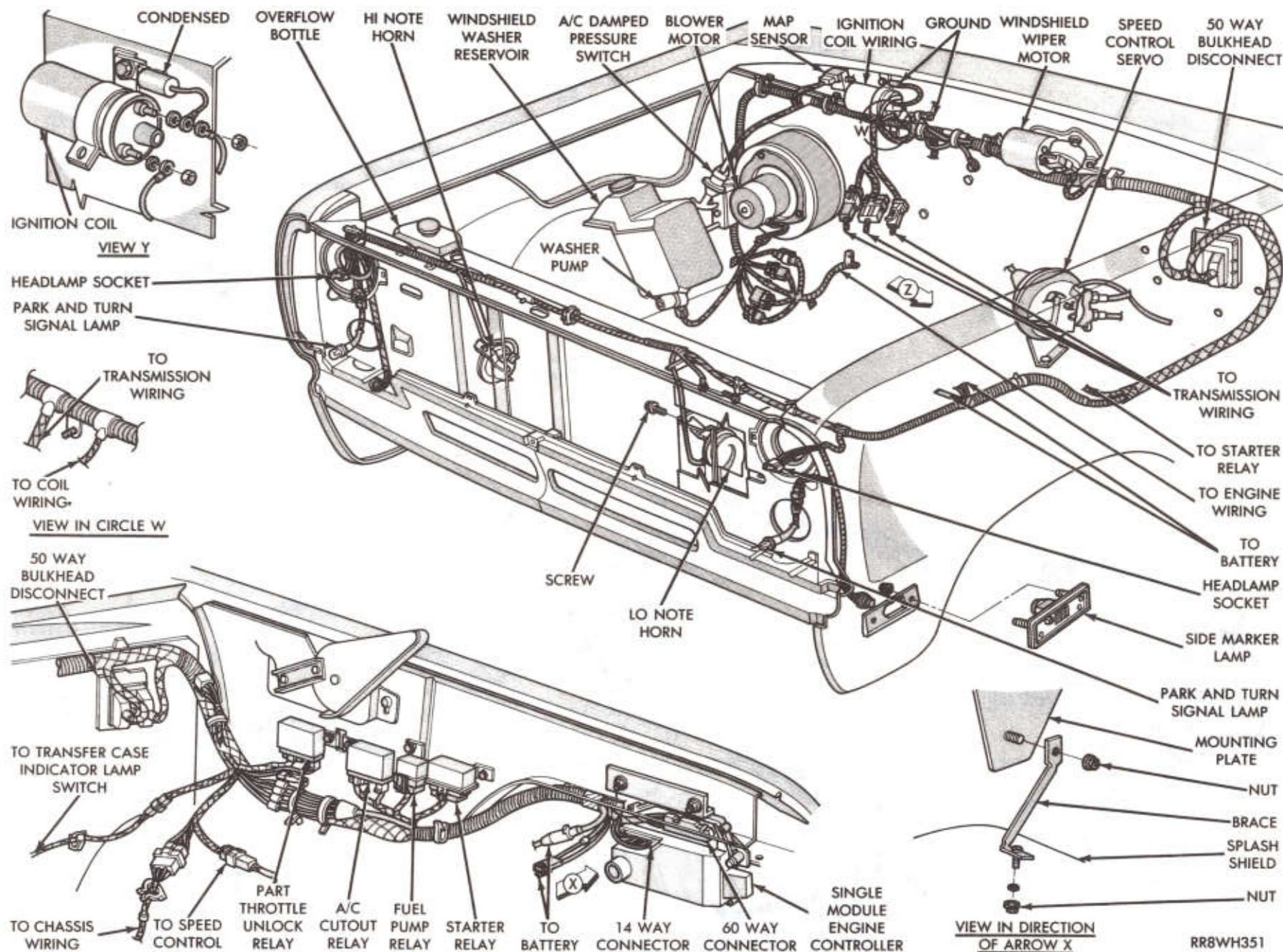


Fig. 16—Engine Compartment Wiring and Component Identification with EFI Ignition

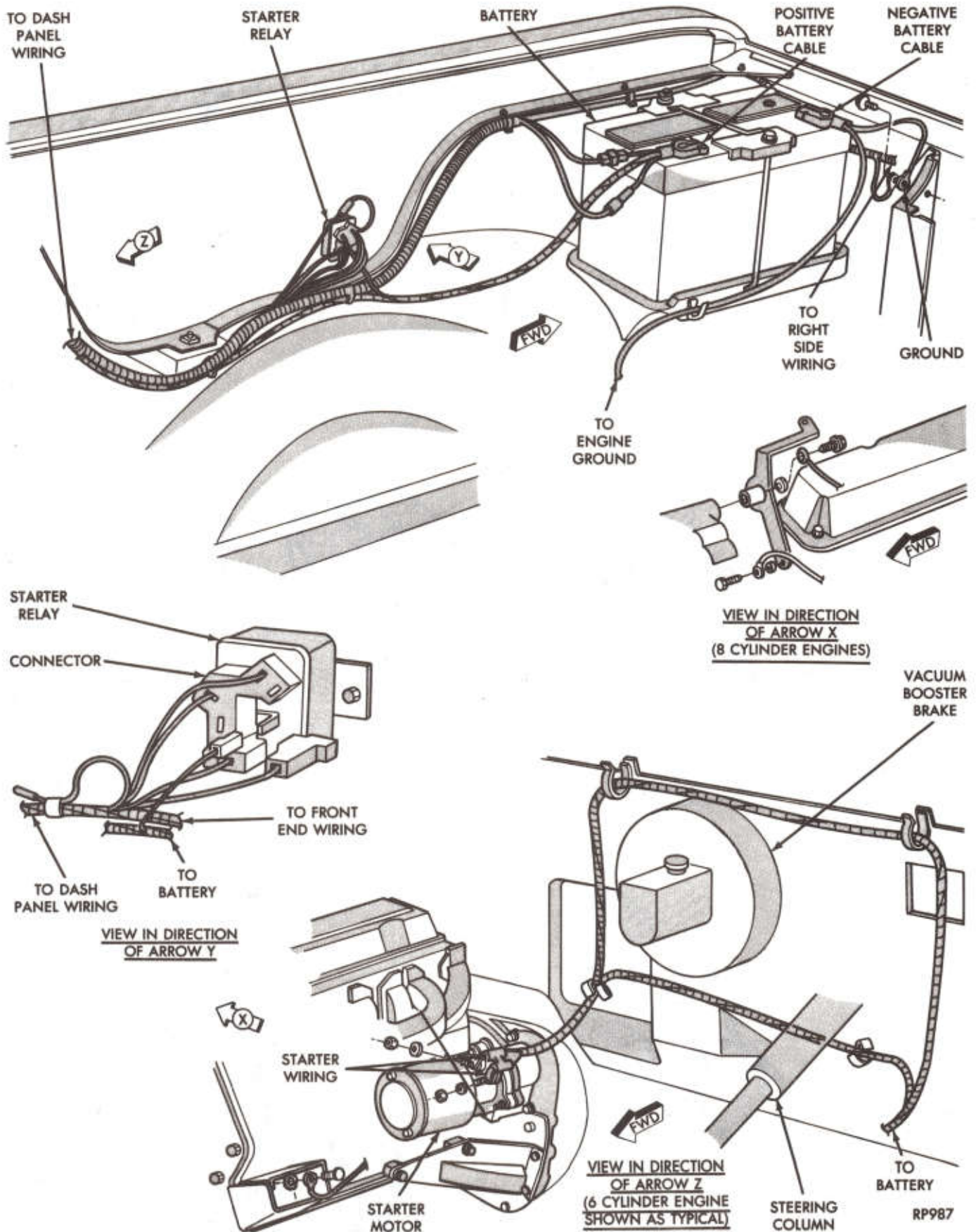


Fig. 17—Starter Motor Wiring and Component Identification

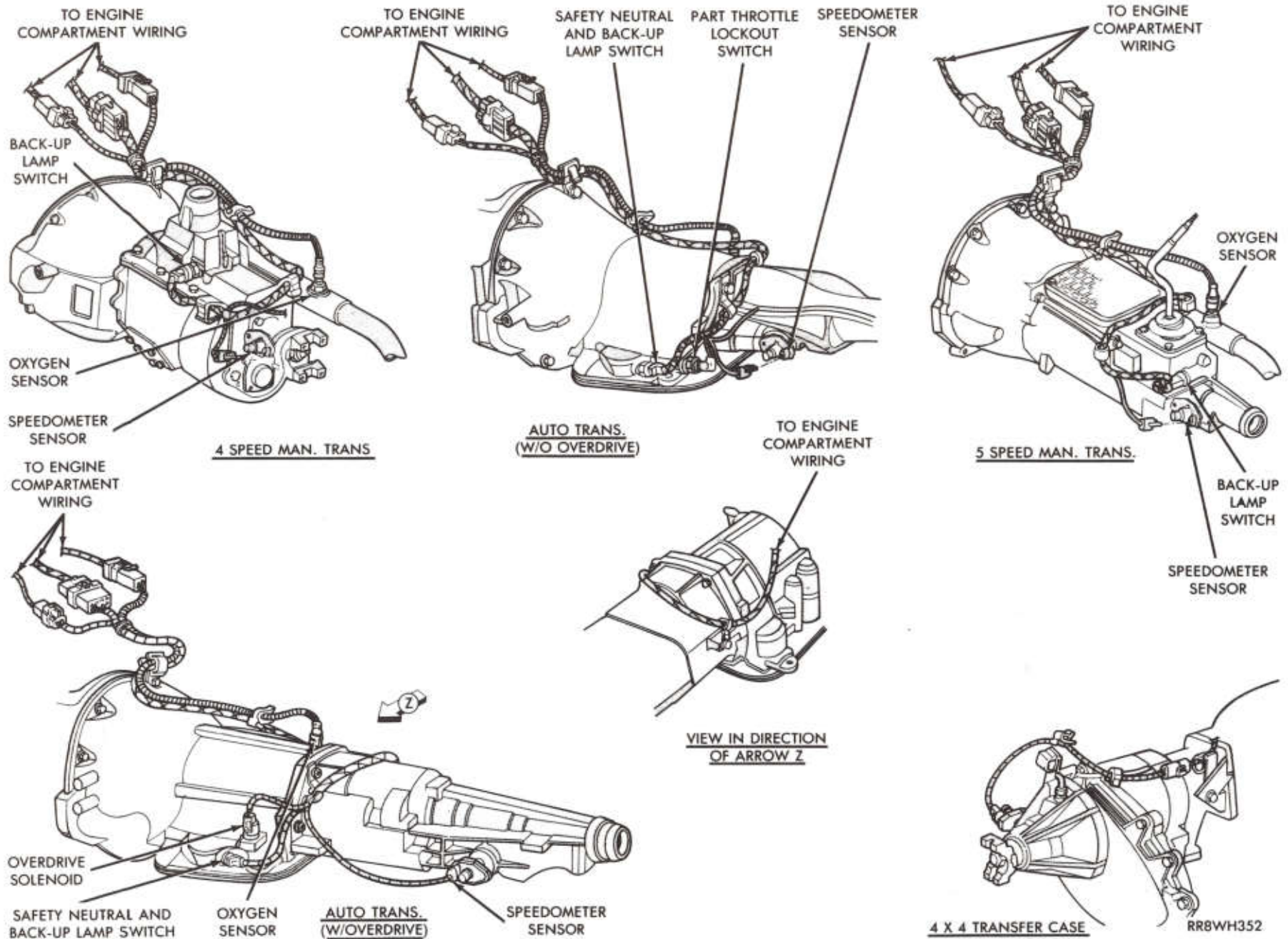


Fig. 18—Transmission Wiring and Component Identification

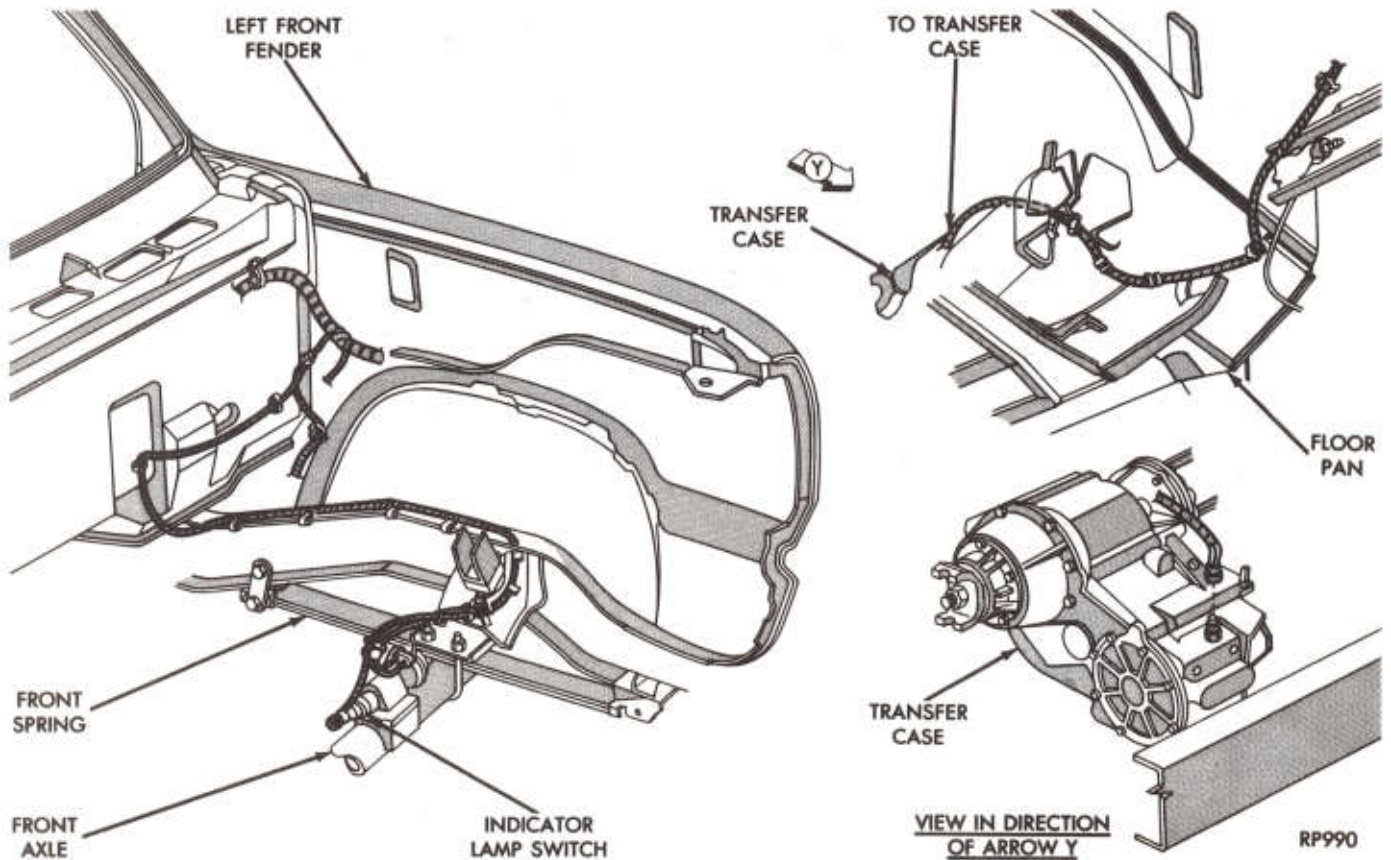


Fig. 19—Four-Wheel-Drive Wiring and Component Identification

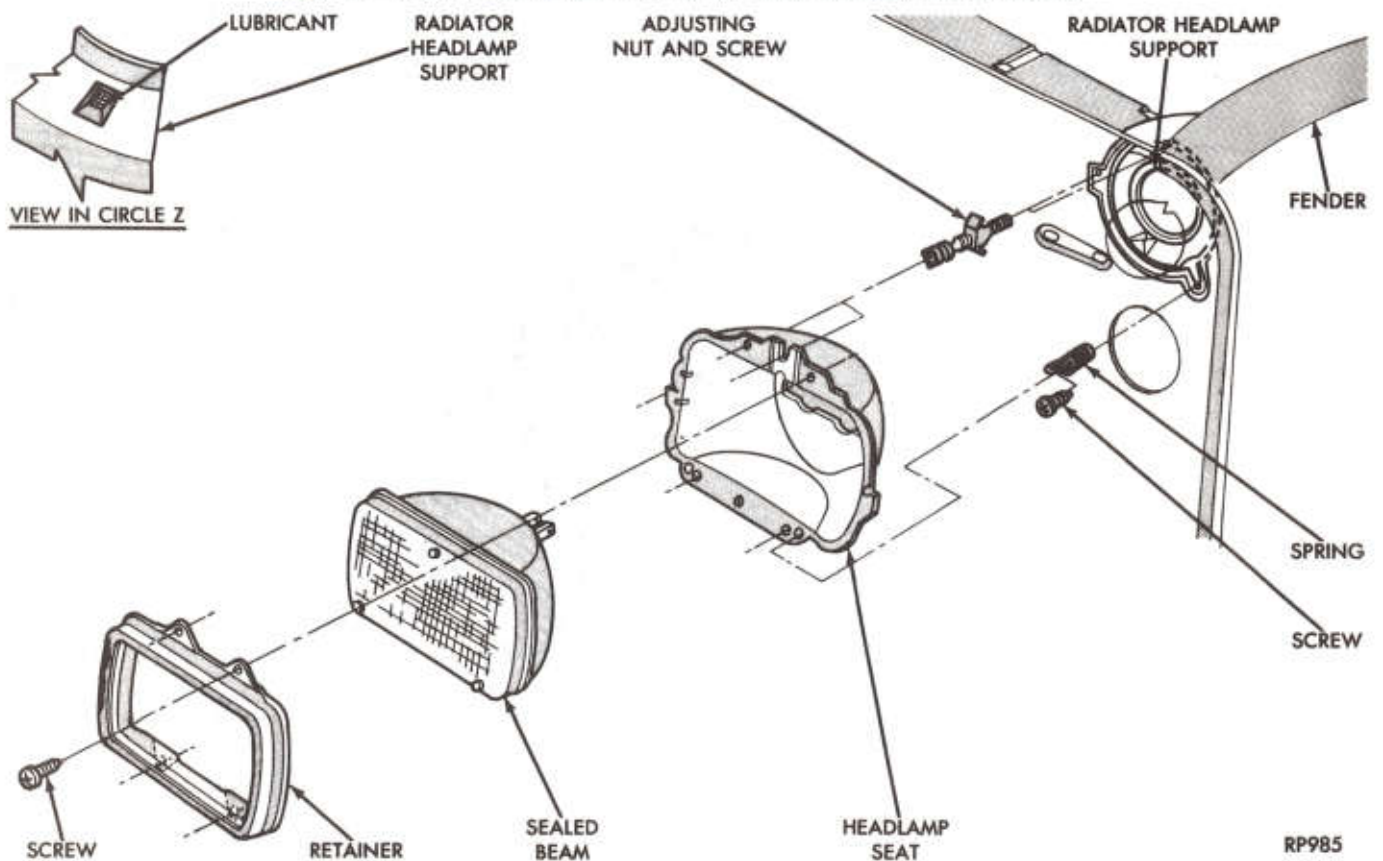


Fig. 20—Headlamp Component Identification

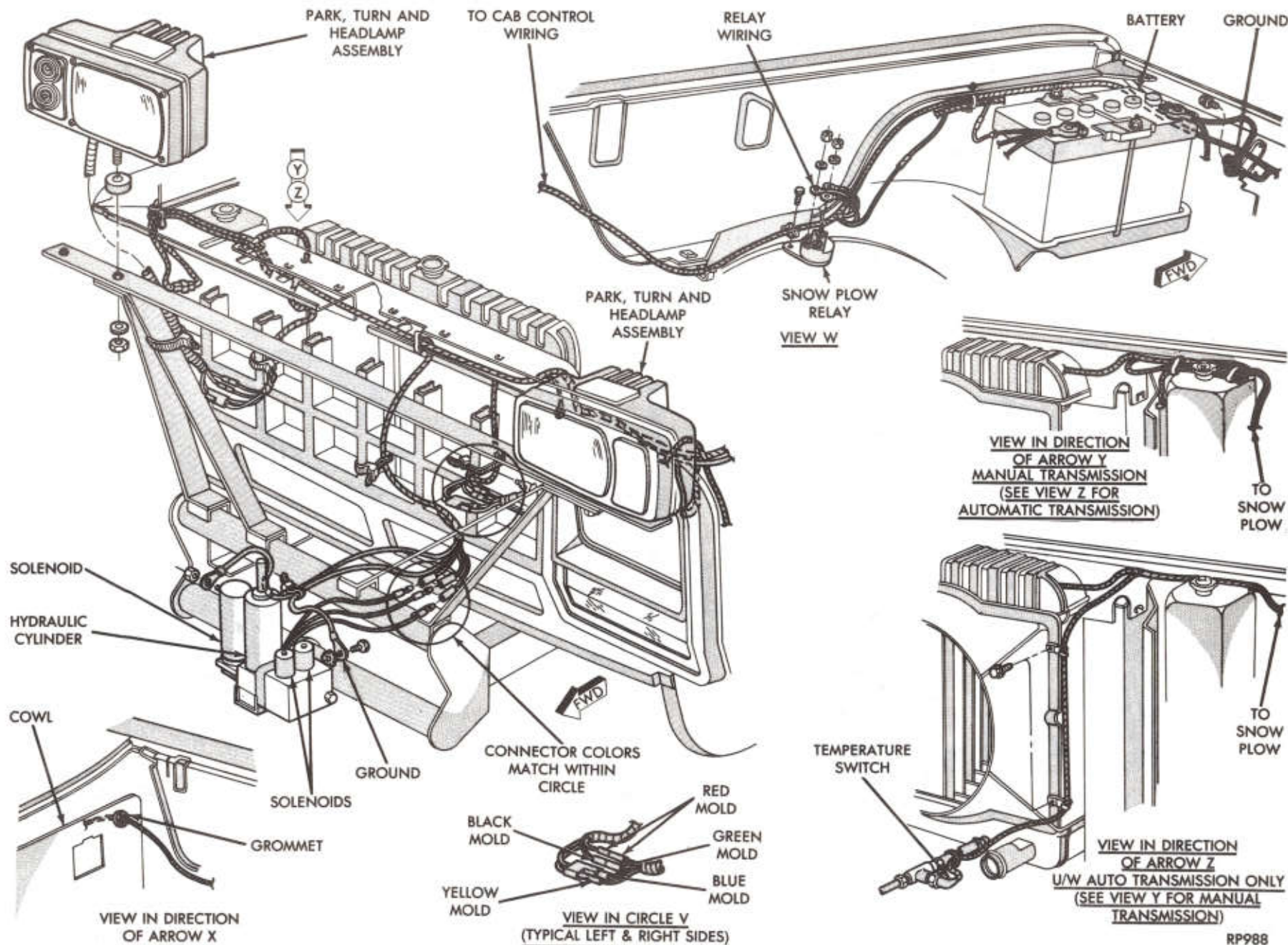


Fig. 21—Snow Plow Wiring and Component Identification



Fig.22—Engine Wiring and Component Identification 3.9L and 5.2L TBI Engine

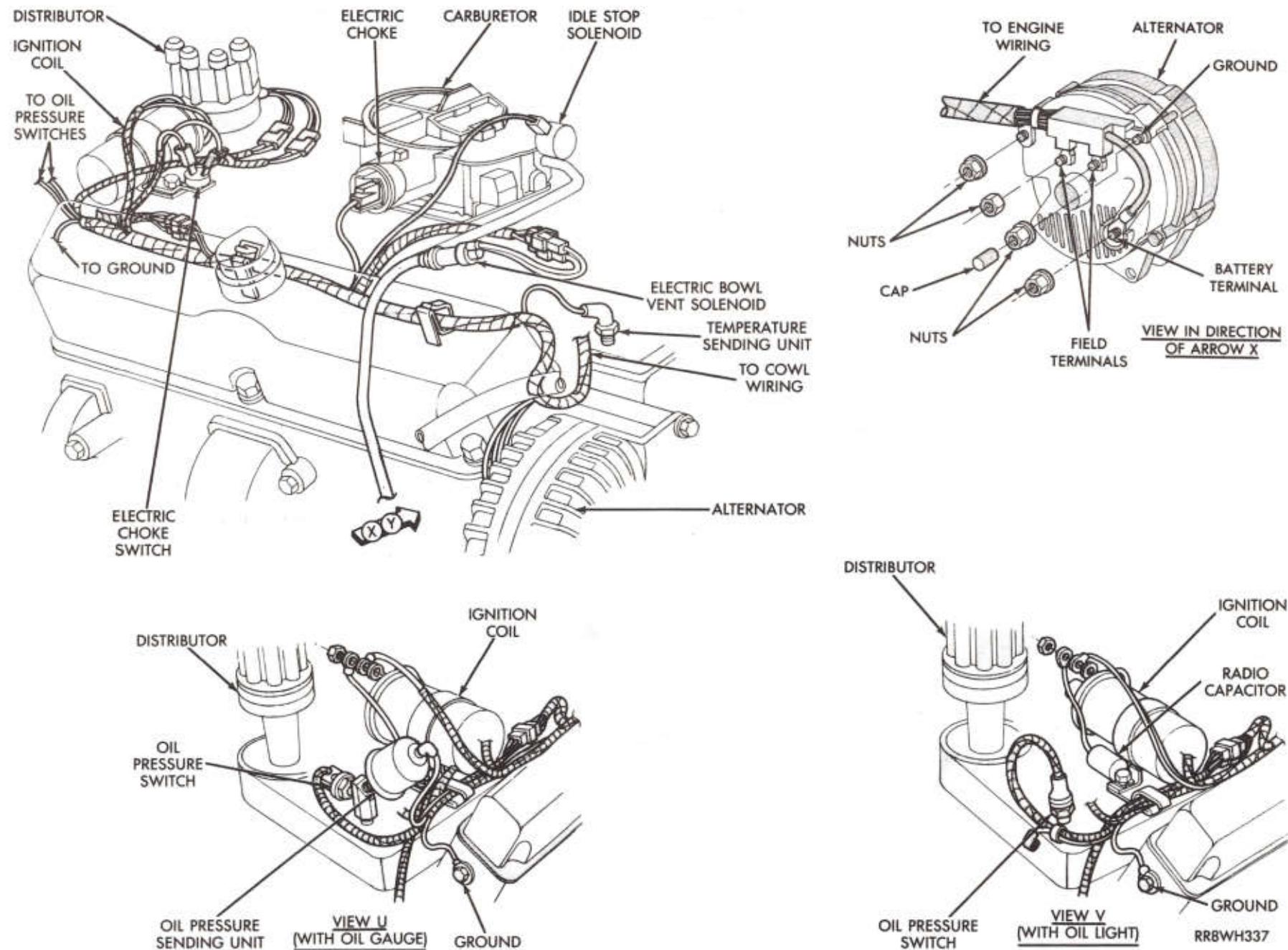


Fig. 23—Engine Wiring and Component Identification 5.9L 4BBL 360 C.I.D. Engine with ECU Ignition

RR8WH337

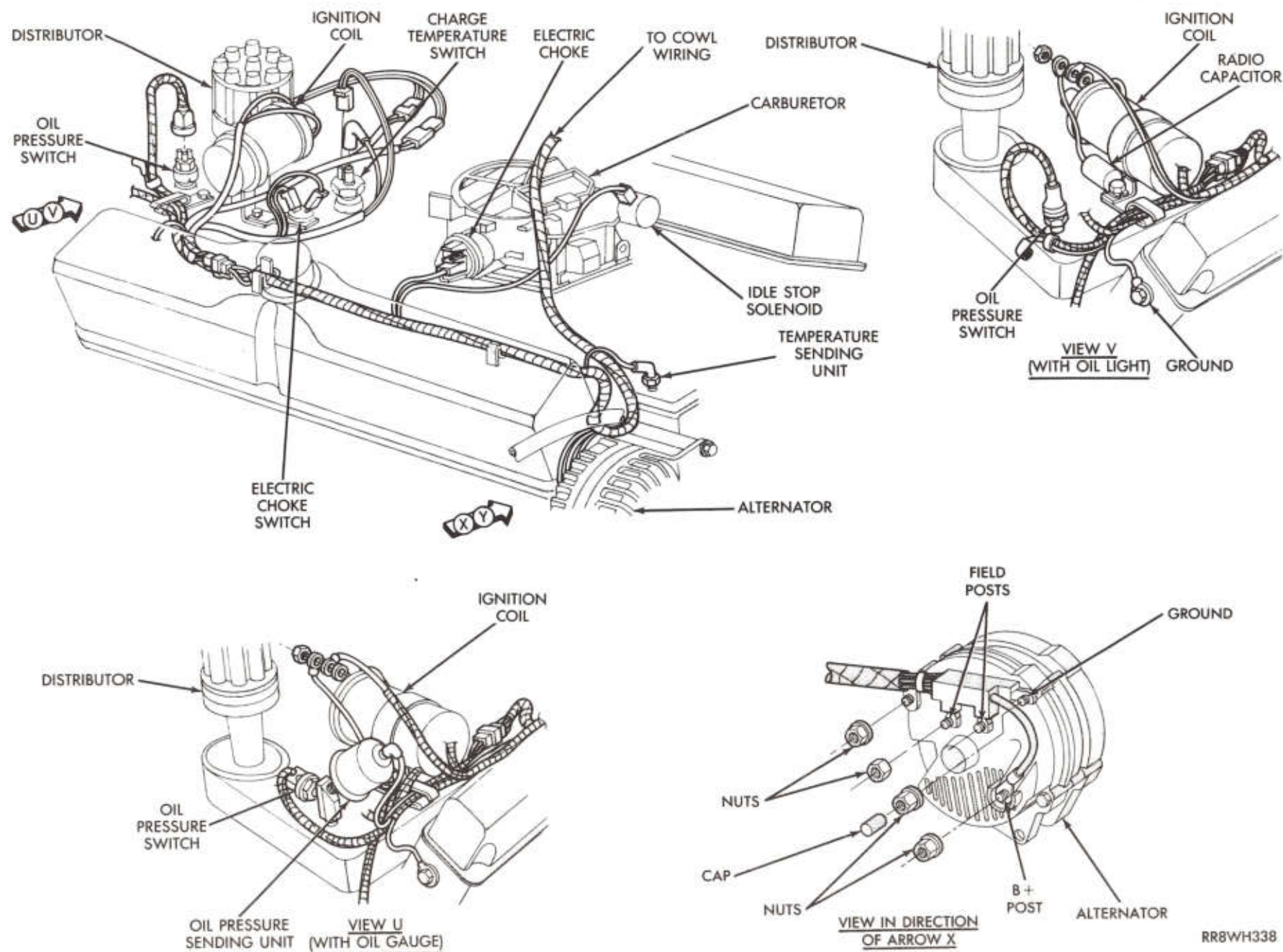


Fig. 24—Engine Wiring and Component Identification 5.9L 4BBL 360 C.I.D.

SPlice INDEX								
Splice Number	Figure Number	Model	Splice Number	Figure Number	Model	Splice Number	Figure Number	Model
A1	5-8	D	J9	5-6	D	R-6-1	5	D
C4	9	D	J9-1	5-6	D	R6-3	5-6	D
C7	9	D	K5	9	D	R9	11	D
C13	4	D	K5-1	11	D	S5	8	D
C20	5-6	D	K8	9	D	W1	8	D
D1	8	D	K14	9	D	W8	1	D
D5	5-6	D	L1	4	D	X2	3	D
D6	5-6	D	L7	3	D	X2-1	2	D
E2	4	D	L7-1	4	D	X2-2	3	D
G5	4	D	L7-2	5-6	D	X2-3	2	D
H2	5	D	L9-1	5-6	D	X33-1	1	D
H4-1	4	D	M1	4	D	X34-1	1	D
H4-2	4	D	M2	4	D	X55	8	D
H4-3	4	D	N5	10	D	X56	8	D
J2	5-6	D	N5-1	11	D	Y5	5-6	D
J2-2	11-12	D	N6	9	D	Z1	6	D
J2-3	5	D	P5	4	D			

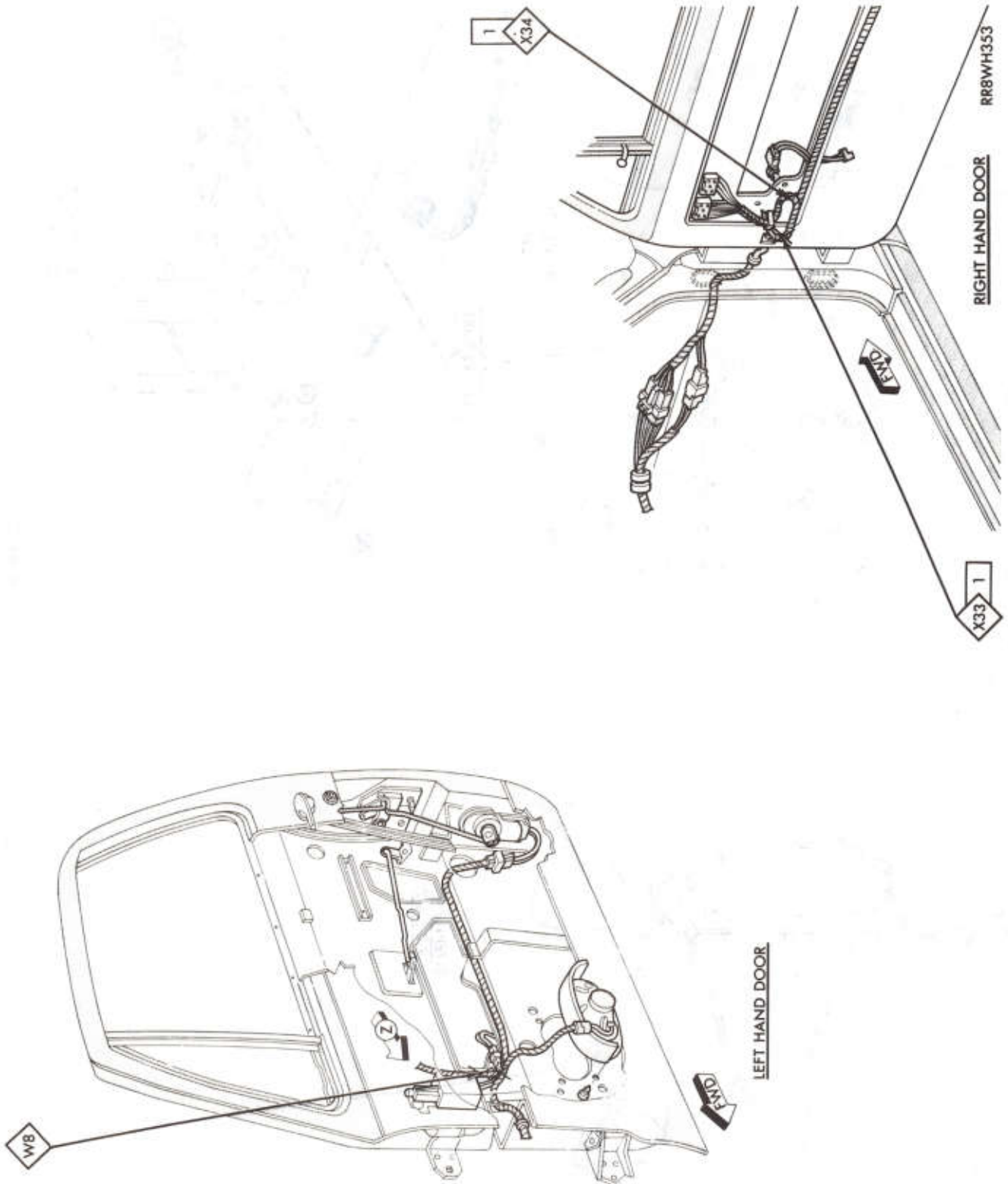


Fig. 1—Door Splices

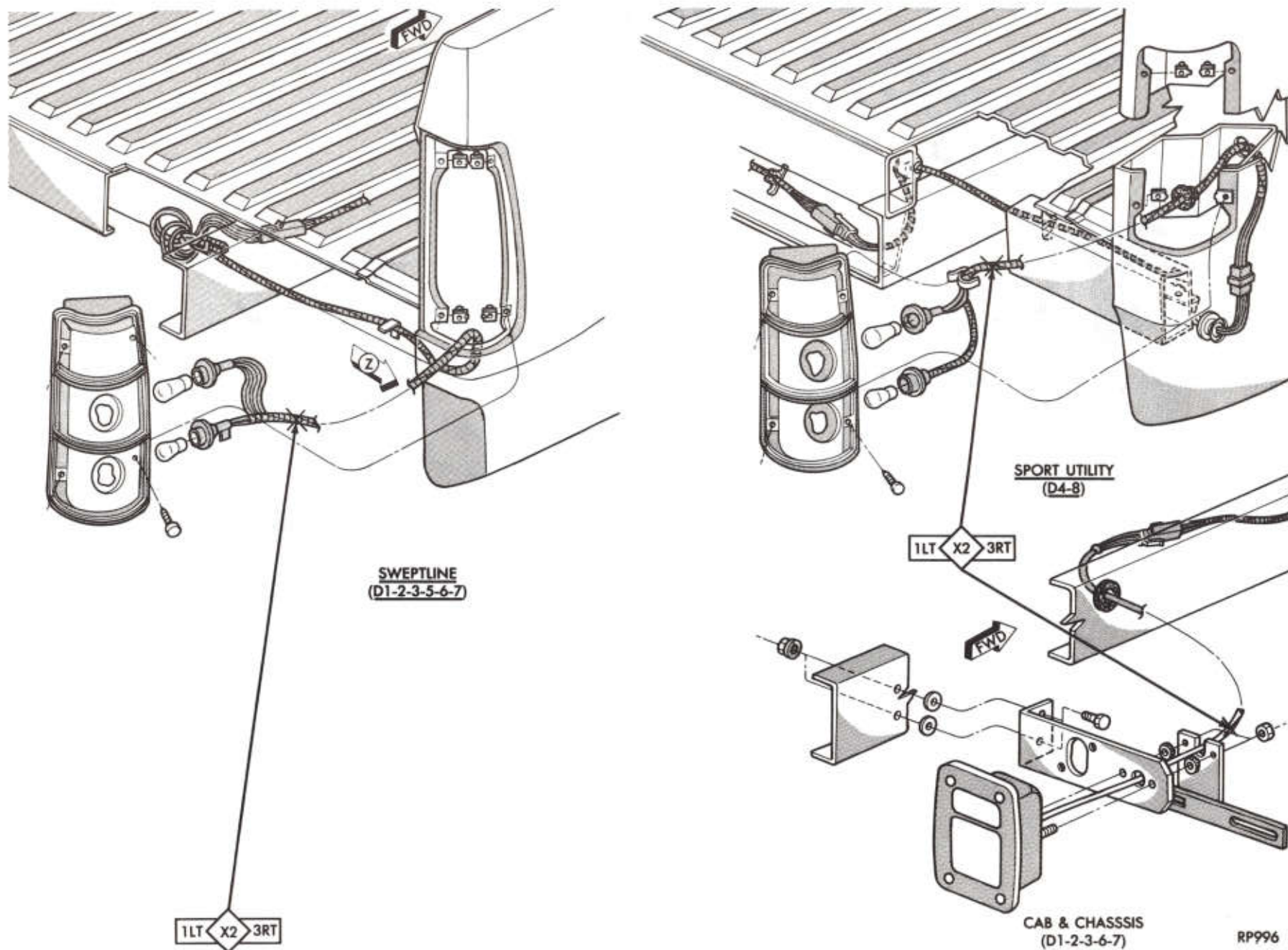


Fig. 2—Tail, Stop, and Turn Signal Splices

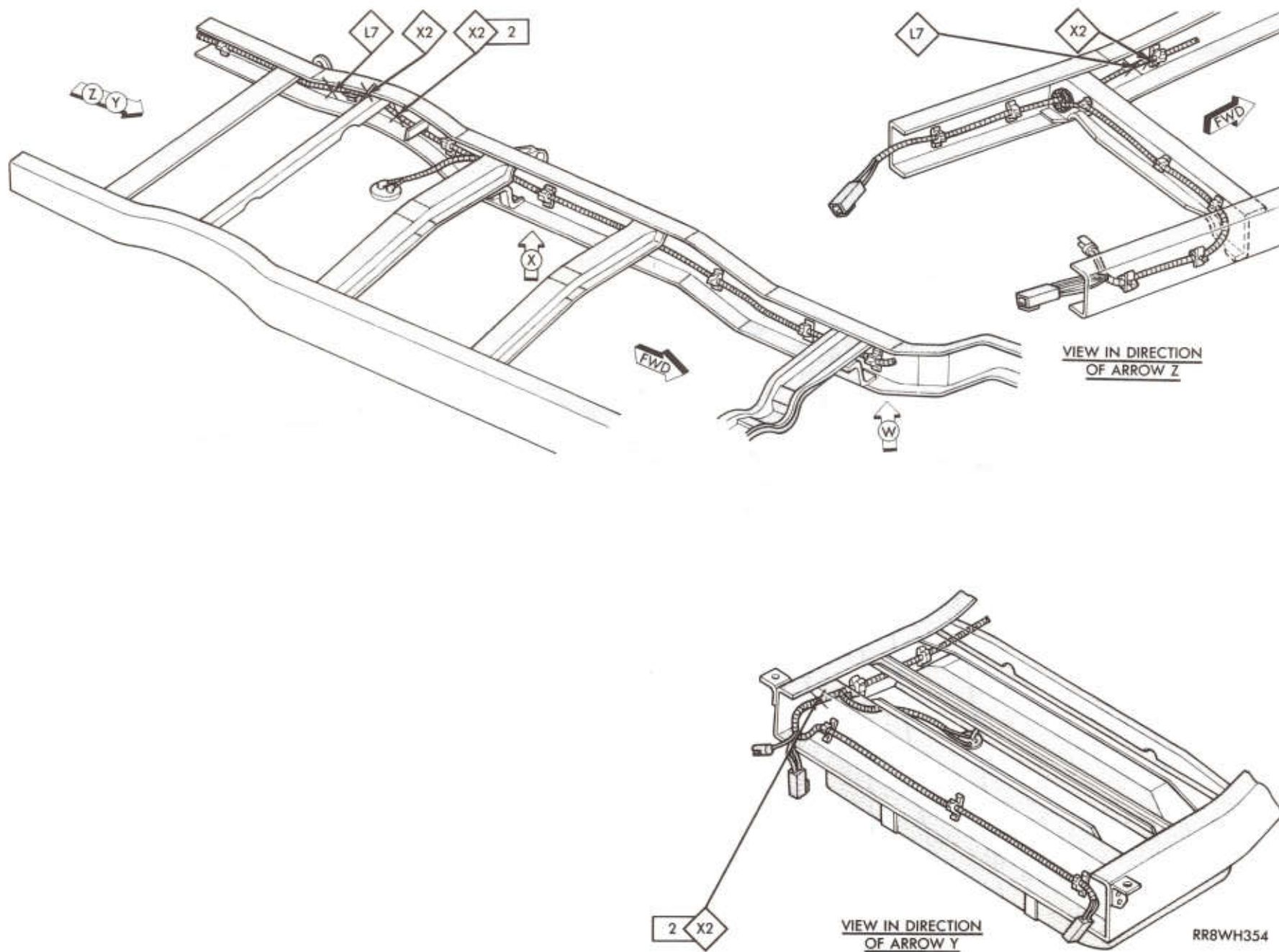


Fig. 3—Frame Splices

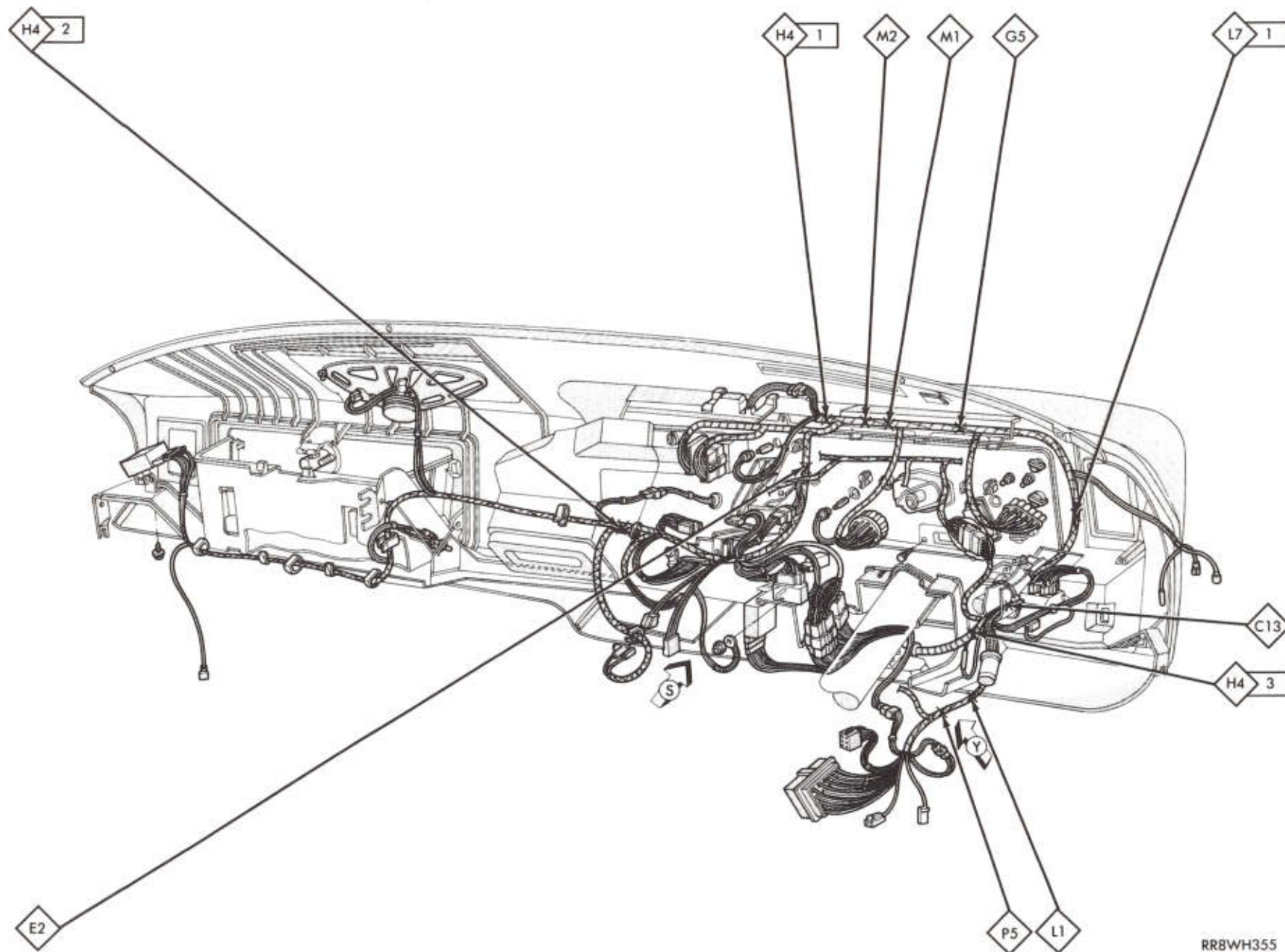


Fig. 4—Instrument Panel Splices

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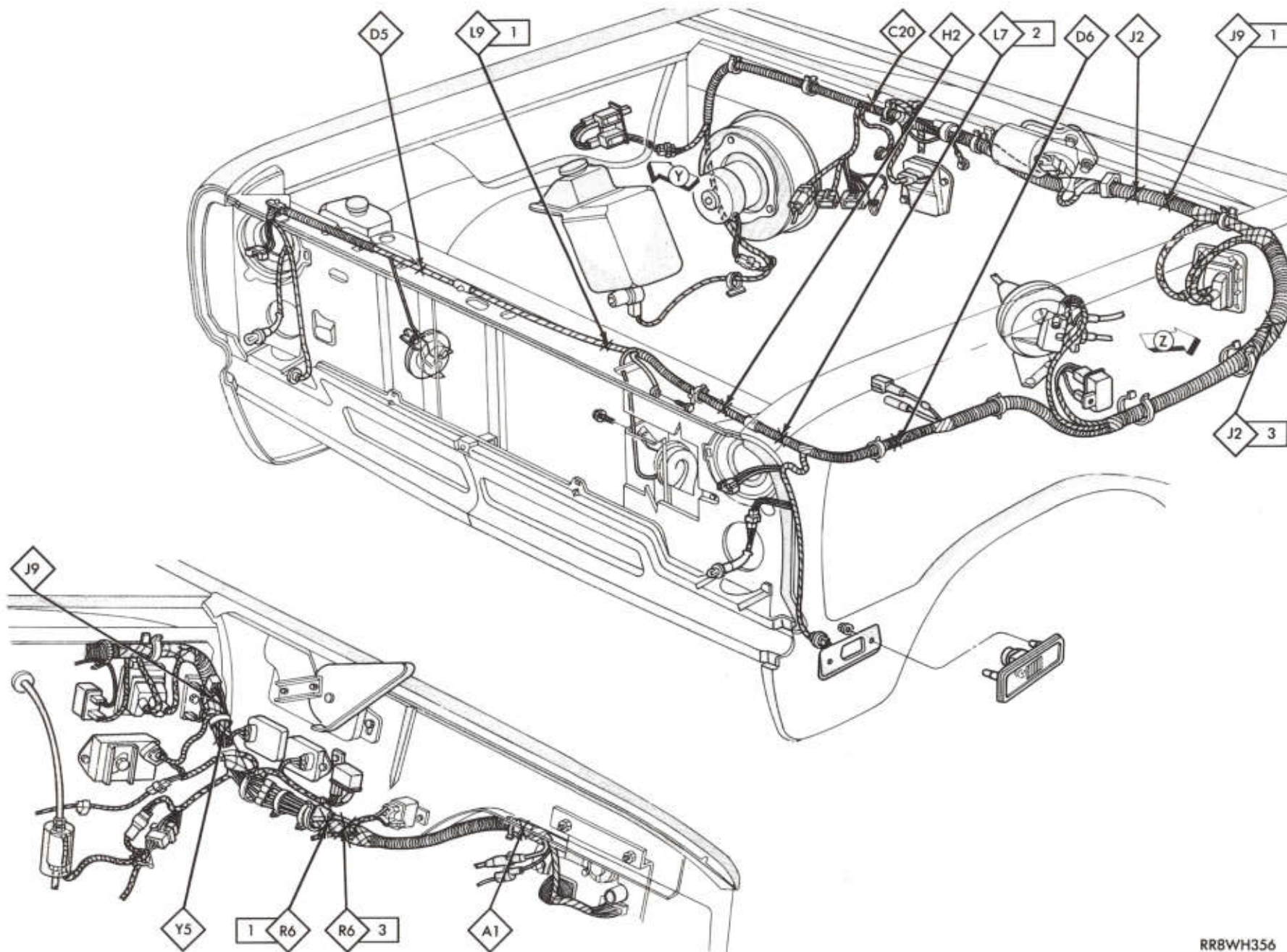
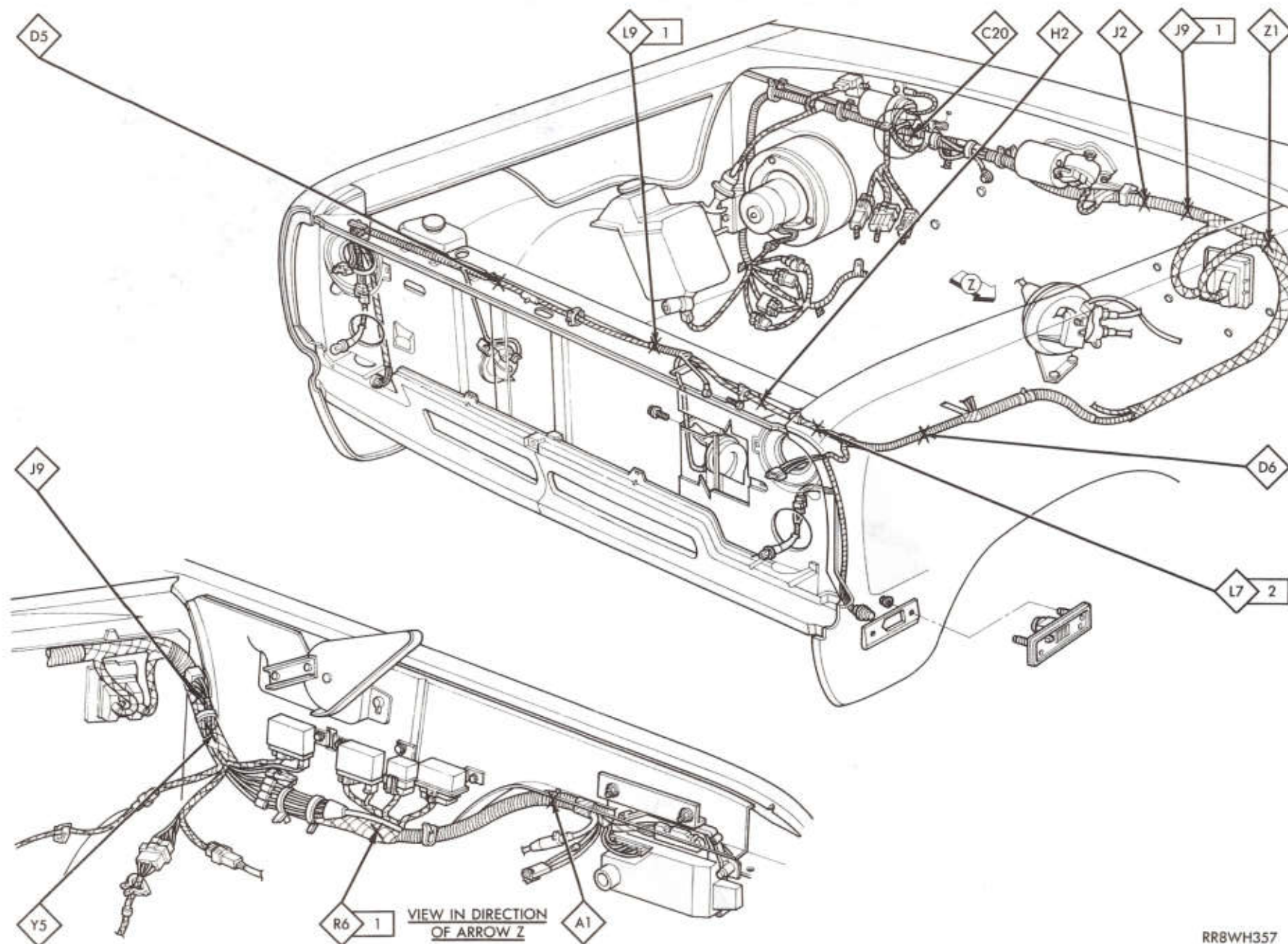


Fig. 5—Engine Compartment Splices with ECU Ignition

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Fig. 6—Engine Compartment Splices with EFI Ignition

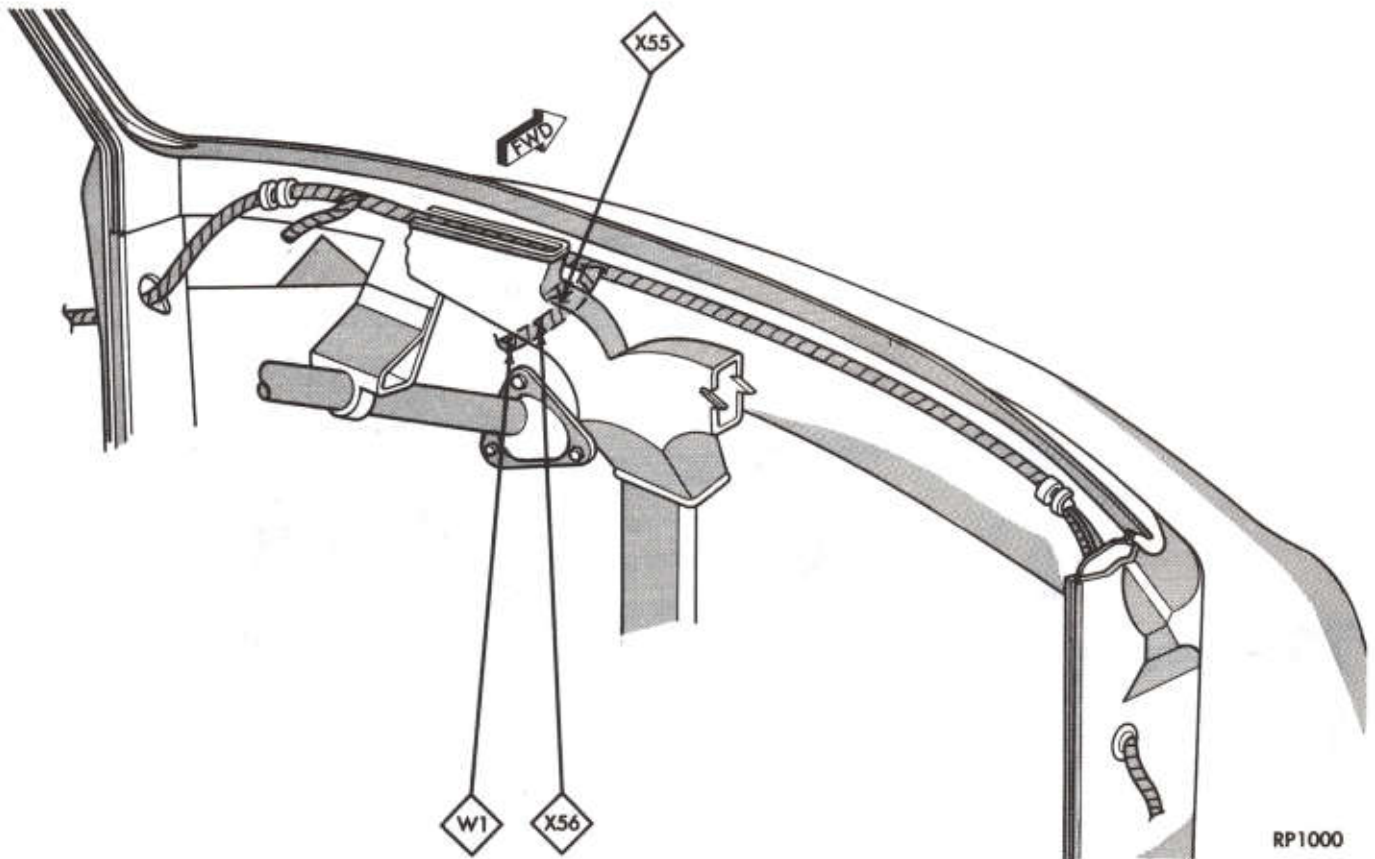


Fig. 7—Dash Panel Splices

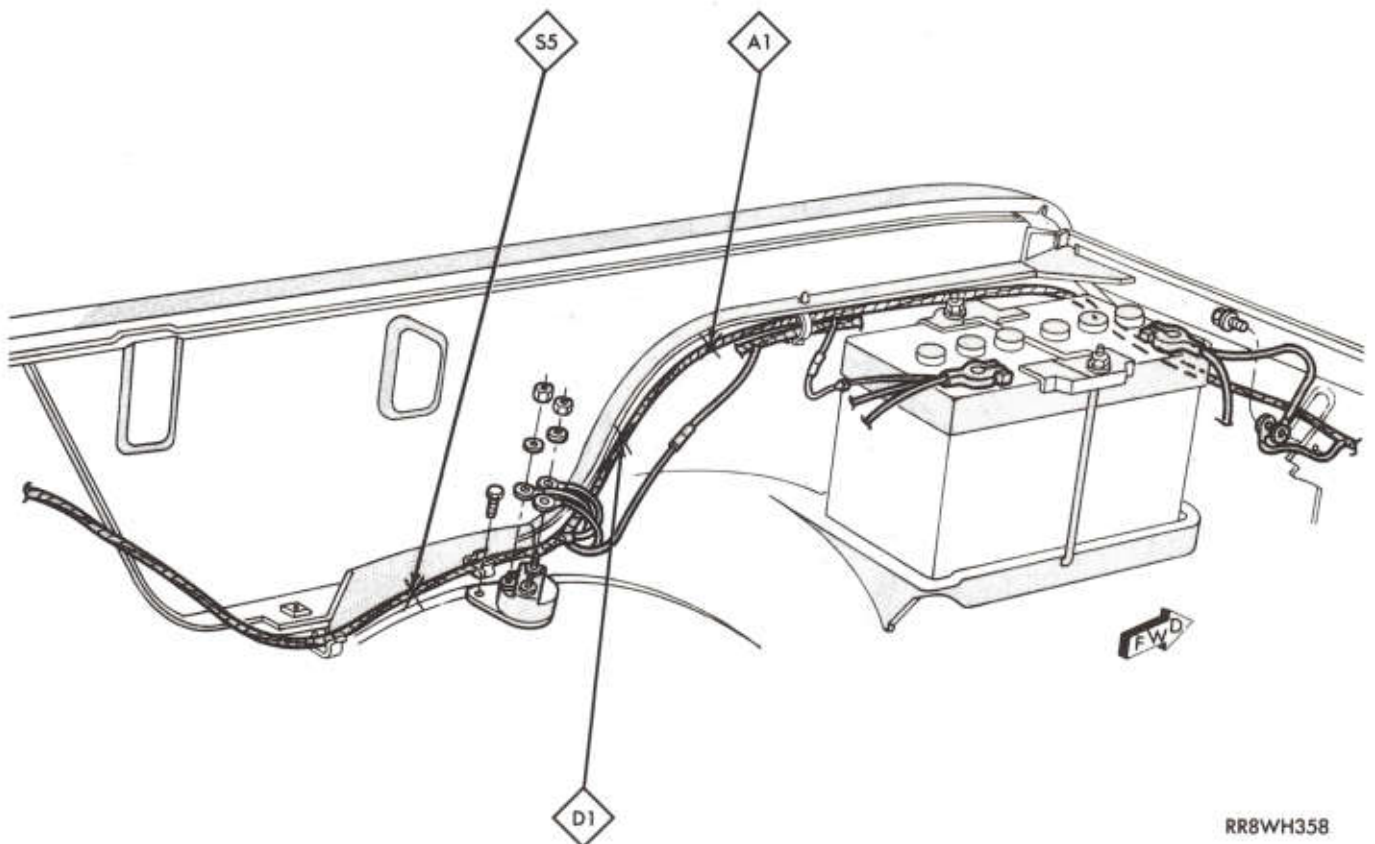
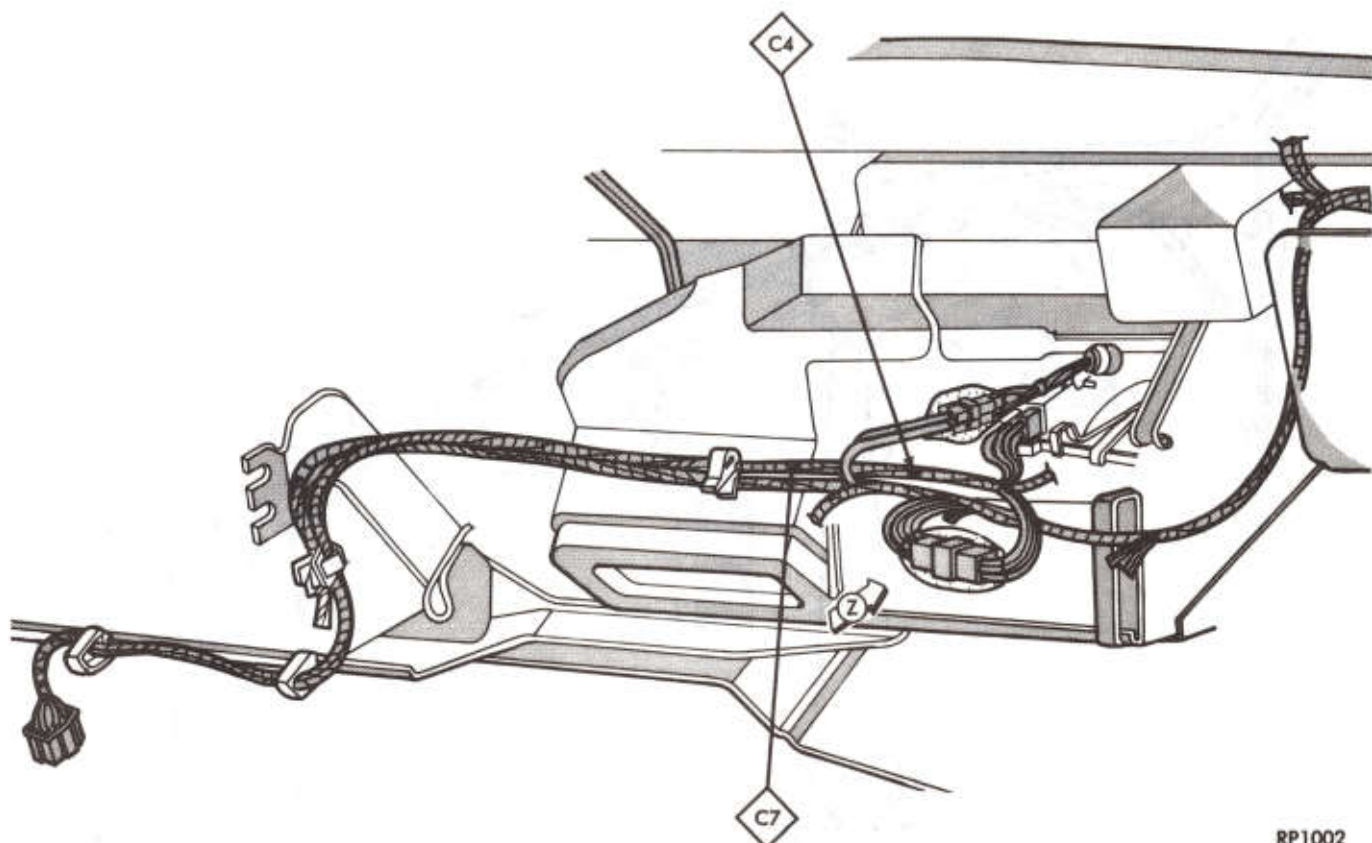
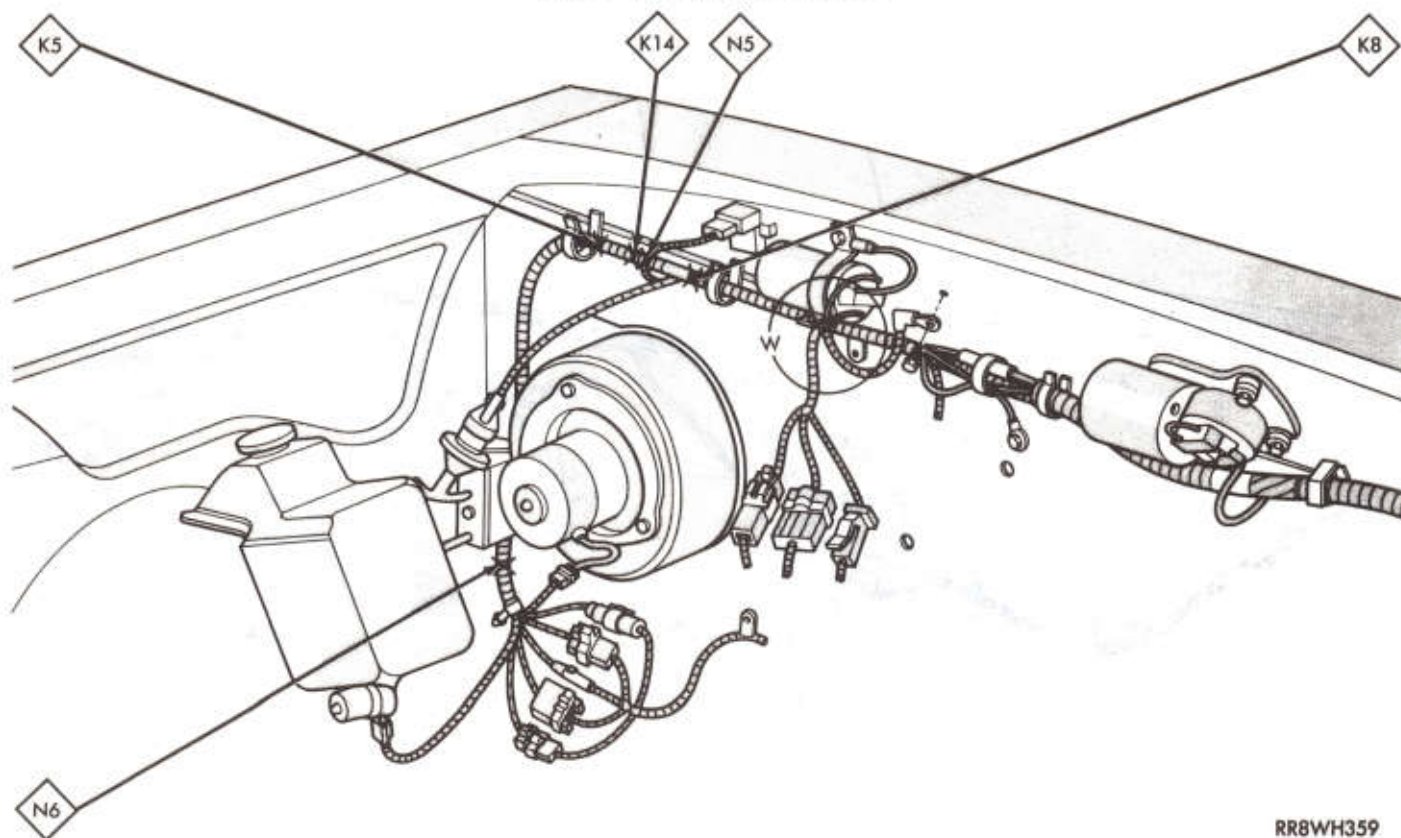


Fig. 8—Snow Plow Wiring Splices



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Fig. 9—Heater A/C Splices



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Fig. 10—Engine Compartment Cowl Splices

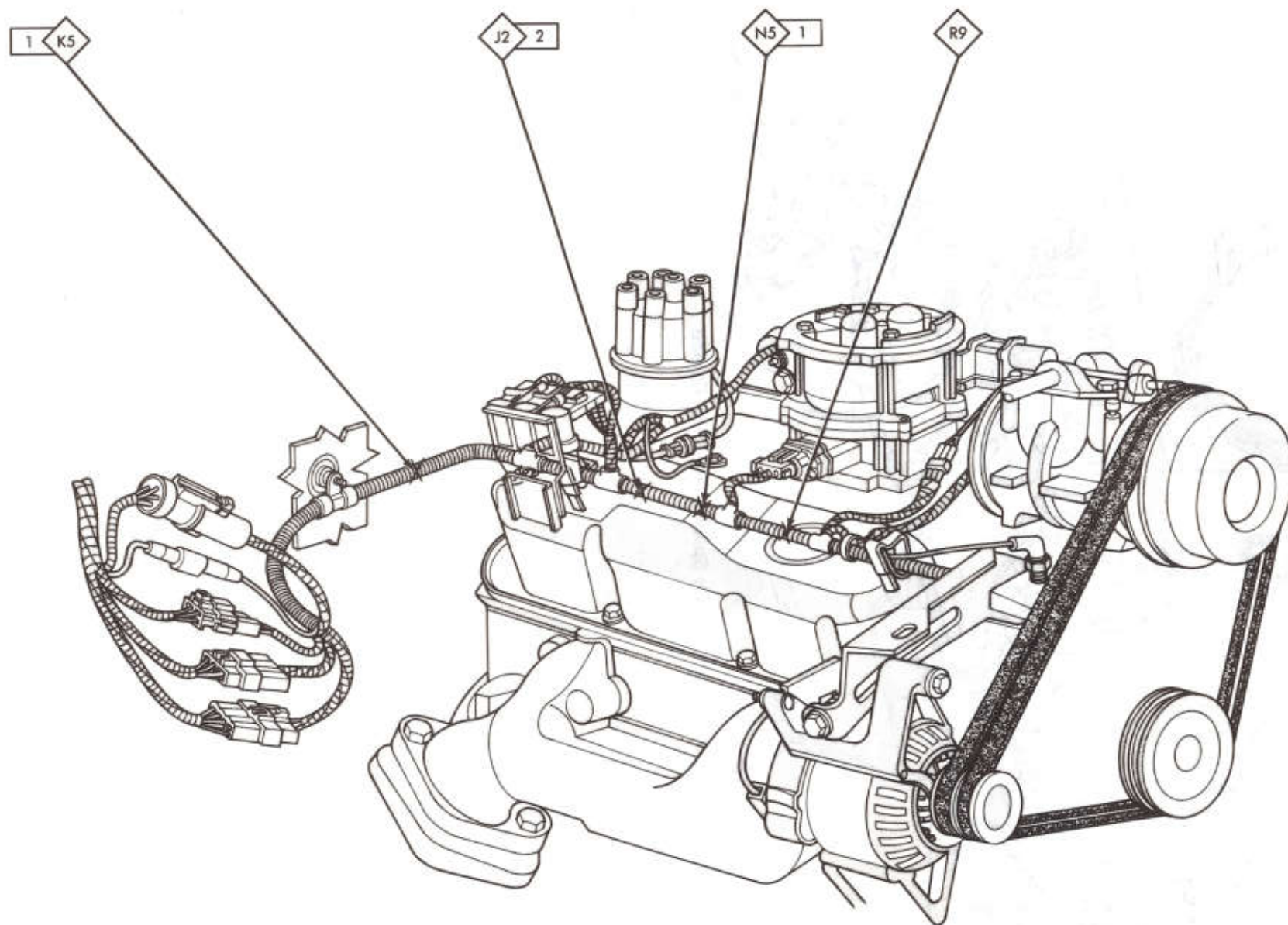
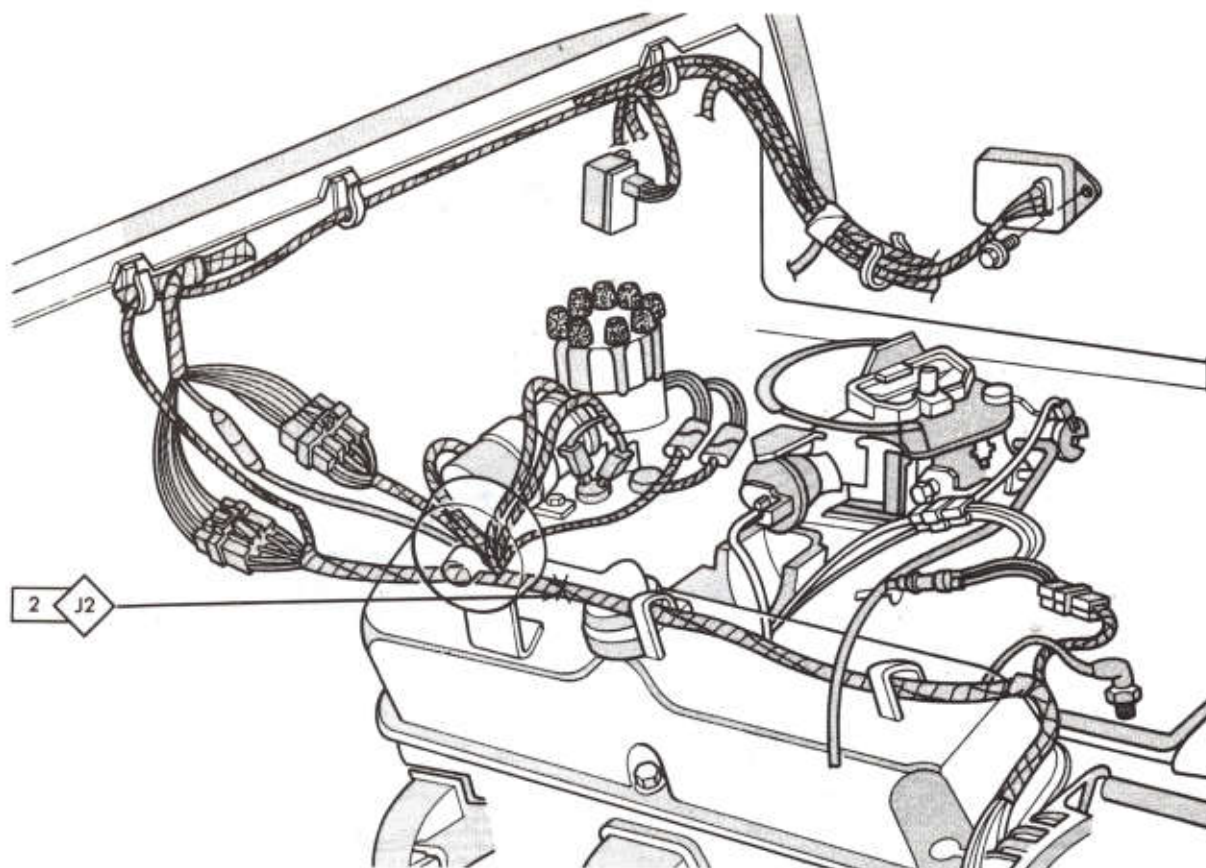


Fig. 11—Engine Splices 3.9L and 5.2L Engine with EFI Ignition

RR8WH360



RR8WH361

Fig. 12—Engine Splices 360 C.I.D. Engine

ELECTRICAL WIRING DIAGRAMS **WIRE ROUTING AND COMPONENT LOCATION**

ALPHABETICAL INDEX

Name	Wiring Diagram Sheet Number	Name	Wiring Diagram Sheet Number
A/C Heater System With ECU Ignition	49-50	Blower Motor Heater	48
Blower Motor	49	Brake Warning Indicator Lamp	40
Clutch	50	Brake Warning Indicator Lamp Switch	21
Compressor	50	Bulkhead Disconnect 50-Way	65-66
Damped Pressure Switch	50	Cavity 1	4-6-26
Diodes	50	Cavity 2	4-8-49-51
Fuse	49	Cavity 5	23-27
Lamp-Switch Illumination	28	Cavity 6	23-27
Low Pressure Switch	50	Cavity 7	25
Resistor	49	Cavity 8	25
Switch-Blower	49	Cavity 9	25
Switch Illumination	28	Cavity 12	9
Switch-Vacuum	49	Cavity 13	9
Vacuum Control Switch	49	Cavity 15	37-61
A/C Heater System With EFI Ignition	51-52	Cavity 16	37-61
Blower Motor	51	Cavity 17	16-18-20-22
Clutch	52	Cavity 18	22
Compressor	52	Cavity 19	16-18-20-21-22
Damped Pressure Switch	52	Cavity 21	23-37
Diodes	52	Cavity 22	24-37
Fuse	51	Cavity 23	3-5-37
Lamp-Switch Illumination	28	Cavity 26	23-27-61
Low Pressure Switch	52	Cavity 27	7-8
Resistor	51	Cavity 28	61
Switch-Blower	51	Cavity 29	45-47
Switch Illumination	28	Cavity 31	8-10-15-17
Switch-Vacuum	51	Cavity 32	26
Vacuum Control Switch	51	Cavity 34	21
Wide Open Throttle Cutout Switch	52	Cavity 35	46-47
Air Switch Recirculation Valve	18	Cavity 36	46-47
Air Switching Solenoid	15-17	Cavity 37	49-51
Alternator With ECU Ignition	6	Cavity 38	13
Alternator With EFI Ignition	4	Cavity 39	59-60
AM Radio with Single Speaker	41	Cavity 40	53
AM/FM Stereo Radio	42	Cavity 41	37
AM/FM Stereo Radio with Cassette	43-44	Cavity 43	3-5
Ammeter With ECU Ignition	5	Cavity 44	3-5
Ammeter With EFI Ignition	3	Cavity 45	46-47
Ash Receiver Lamp	28-31	Cavity 46	46-47
Automatic Transmission Neutral Start and Back-Up Lamp Switch With ECU Ignition	8	Cavity 47	10-16-18-20-25-53-59-60
Automatic Transmission Neutral Start and Back-Up Lamp Switch With EFI Ignition	7	Cavity 48	4-6
Auxiliary Snow Plow Lamps	32	Cavity 49	4-6-10
Back-Up Lamps	61-62	Cavity 50	4-6-10
Back-Up Lamp Switch With ECU Ignition	8	Buzzer -Combined Headlamp, Key In, and Seat Belt	59-60
Back-Up Lamp Switch With EFI Ignition	7	Carburetor Idle Stop Switch	15-17
Ballast Resistor With ECU Ignition	16-18-20	Cargo Lamp	30
Battery	1-3-5	Cargo Lamp Switch	30
Blower Motor A/C Heater Front	49	Cargo Lamp Switch Indicating Lamp	30
		Charging System With ECU Ignition System	5-6

Name	Wiring Diagram Sheet Number	Name	Wiring Diagram Sheet Number
Alternator	6	Left Motor	54
Ammeter	5	Right Door Switch	54
Battery	5	Right Motor	54
Voltage Regulator	5	Electronic Control Unit	16-18-20
Charging System With EFI Ignition	3-4	Electronic Control Unit Ignition System 5.9L 360 CID Light Duty Federal, Canada, California And High Altitude Manual Transmission Engines	15-16
Alternator	4	Air Switching Relief Valve Timer	16
Ammeter	3	Air Switching Solenoid	15
Battery	3	Ballast Resistor	16
Charge Temperature Switch	15-17	Charge Temperature Switch	15
Check Engine Lamp	40	Distributor	15
Cigar Lighter	31	Dual Pick-Up Relay	15
Circuit Breaker Electric Windows	54	Electric Choke	15
Clearance Lamps	35-36	Electric Choke Heater	15
Cluster Illumination Lamps	39	Electric Control Unit	16
Combined Buzzer	59-60	Exhaust Gas Recirculation Solenoid Valve	16
Compressor-A/C With ECU Ignition	50	Exhaust Gas Recirculation Vacuum Solenoid ...	15
Compressor-A/C With EFI Ignition	52	Idle Stop Switch Solenoid	15
Control Intermittent Wipe	46	Ignition Coil	15
Control-Snow Plow	33	Oil Pressure Sending Unit	15
Connector-Printed Circuit Board		Oil Pressure Switch	15
Left	23-27-28-37-59-60	Temperature Sending Unit	15
Right ..	16-18-20-21-22-24-25-28-37-39-59-60	Electronic Control Unit Ignition System 5.9L 360 CID Light Duty Federal, Canada, California and High Altitude Automatic Transmission Engine	17-18
Coolant Sensor With EFI Ignition System	14	Air Switching Solenoid	17
Courtesy Lamps Rear	29	Air Switch Recirculation Valve	18
Damped Pressure Switch-A/C With ECU Ignition .	50	Ballast Resistor	18
Damped Pressure Switch-A/C With EFI Ignition	52	Charge Temperature Switch	17
Deceleration Throttle Control Solenoid	19	Diode	18
Diagnostic Connector	11	Distributor	17
Dimmer Switch-Headlamp	27	Dual Pick-Up Relay	17
Diode-A/C With ECU Ignition	50	Electric Choke	17
Diode-A/C With EFI Ignition	52	Electric Choke Heater	17
Diode Assembly-Lamp	29	Electronic Control Unit	18
Diode-Ignition	18	Exhaust Gas Recirculation Solenoid Valve	18
Distance Sensor	14	Exhaust Gas Recirculation Vacuum Solenoid ...	17
Distributor	14-15-17-19	Idle Stop Switch Relay	18
Dome Lamp	30	Idle Stop Switch Solenoid	17
Dome Lamp Switch	30	Ignition Coil	17
Door Jamb Courtesy Lamp Switches	30	Oil Pressure Sending Unit	17
Left Front Switches	30	Oil Pressure Switch	17
Right Front Switches	30	Temperature Sending Unit	17
Door Locks-Electric	55-56	Electronic Control Unit Ignition System 5.9L 360 CID Heavy Duty Engine	19-20
Dual Pick-Up Switch Relay	15-17	Ballast Resistor	20
Electric Choke	15-17-19	Decel Throttle Control Solenoid	19
Electric Choke Control	15-17-19	Distributor	19
Electric Choke Heater	15-17-19	Electric Choke	19
Electric Door Lock System	55-56	Electric Choke Heater	19
Circuit Breaker	55	Electric Speed Switch	19
Left Door Motor	55	Electronic Control Unit	20
Right Door Motor	56		
Left Door Switch	55		
Right Door Switch	56		
Electric Window Lift System	54		
Circuit Breaker	54		
Left Door Switch	54		

Name	Wiring Diagram Sheet Number	Name	Wiring Diagram Sheet Number
Ignition Coil	19	Cavity 26	13
Oil Pressure Sending Unit	19	Cavity 29	13
Oil Pressure Switch	19	Cavity 30	13
Temperature Sending Unit	19	Cavity 31	11
Electronic Fuel Injection Ignition System		Cavity 32	12
3.9L And 5.2L Engine	11-12-13-14	Cavity 33	12
Air Switching Solenoid	12	Cavity 34	13
Auto Shutdown Relay	12	Cavity 38	13
Diagnostic Connector	11	Cavity 39	11
Distance Sensor	14	Cavity 40	41
Distributor	14	Cavity 41	13
Engine Coolant Sensor	14	Cavity 45	11
Exhaust Gas Recirculation Solenoid	12	Cavity 47	14
Heated Oxygen Sensor	11	Cavity 48	14
Ignition Coil	12	Cavity 51	11
Injectors	11	Cavity 52	14
Map Sensor	14	Cavity 54	12
Purge Solenoid	12	Cavity 55	13
Single Module Engine Connector ...	11-12-13-14	Cavity 56	11
Throttle Kicker Motor	13	Cavity 58	11
Throttle Position Sensor	11	Cavity 59	13
Emission Maintenance Reminder Control Unit	26	Exhaust Gas Recirculation Timer	16-18
Emission Maintenance Reminder Lamp	39	Exhaust Gas Recirculation Solenoid	12-15-17
Engine Controller-Single Module		Flasher-Hazard Warning	37
Engine Controller 14-Way Connector	64	Flasher-Turn Signal	37
Cavity 1	14	Foot Dimmer Switch-Headlamp	27
Cavity 2	11	Four Wheel Drive Indicator Lamp	25-53
Cavity 3	12	Four Wheel Drive Indicator Lamp Switch	53
Cavity 4	12	Front A/C and Heater With ECU Ignition	49-50
Cavity 5	12	Front A/C and Heater With EFI Ignition	51-52
Cavity 6	11	Front Dome Lamp	30
Cavity 7	11	Front Door Courtesy Lamp Switches	30
Cavity 8	12	Front Door Jamb Switch Left	30
Cavity 9	11	Front Door Jamb Switch Right	30
Cavity 10	11	Front Door Lock System	55-56
Cavity 11	12	Front Door Window Lift System	54
Cavity 12	12	Front End Lighting	23-24
Cavity 13	13	Front Headlamp Left	23
Cavity 14	13	Front Headlamp Right	24
Engine Controller-Single Module		Front Park Lamp Left	23
Engine Controller 60-Way Connector	63	Front Park Lamp Right	24
Cavity 1	14	Front Side Marker Lamp Left	23
Cavity 3	14	Front Side Marker Lamp Right	24
Cavity 4	14	Front Turn Signal Lamp Left	23
Cavity 5	11	Front Turn Signal Lamp Right	24
Cavity 10	12	Fuel Gauge	39
Cavity 12	12	Fuel Gauge Sending Unit-Carbureted	59
Cavity 13	14	Fuel Gauge Sending Unit With EFI	60
Cavity 14	12	Fuse Application Chart	1-2
Cavity 15	11	Fuse Block Module and Relay Bank	69
Cavity 16	11	Fuses	
Cavity 17	13	Fuse 1	2-10-48-49-51
Cavity 19	13	Fuse 2	2-10-54
Cavity 22	11	Fuse 3	1-37
Cavity 23	11	Fuse 4	2-10-37-41-42-43

Name	Wiring Diagram Sheet Number
Fuse 5	2-10-33-37
Fuse 6	2-10-37-46-47
Fuse 7	1-4-6-26-31
Fuse 8	1-4-6-26-27
Fuse 9	1-4-6-25-38
Fuse 10	1-4-6-55
Fuse 11	2-4-6-24-30-31-41-42-43-57
Fuse 12	2-9-10-16-18-20-25-53-59-60
Fuse 13	2-7-8-16-18-20
Fuse 14	1-27-41-42-43
Fusible Links	3-4-5-6
Gauge-Fuel	39
Gauge-Oil Pressure	39
Gauge-Temperature	39
Glove Box Lamp	31
Glove Box Lamp Switch	31
Hazard Warning	37-38
Flasher	37
Fuse	37
Switch	38
Headlamps	23-24
Headlamp Combined Buzzer	60
Headlamp Dimmer Switch	27
Headlamp, Key-in, Seat Belt Buzzer	60
Headlamp Switch	27
Headlamp Switch Controlled Interior Lamps	28
Headlamp Switch On Warning Buzzer	60
Headlamp Switch Title Lamp	28
Heater System-Front	48
Blower Motor	48
Fuse	48
Resistor	48
Switch	48
Switch Illumination Lamp	28
High Beam Indicator Lamp	39
Horn System	26
Horns	26
Horn Relay	26
Horn Switch	26
Idle Stop Switch	15-17
Idle Stop Switch Relay	18
Idle Stop Switch Solenoid	15-17
Identification Lamps	35-36
Ignition Coil	12-15-17-19
Ignition Switch	10
Ignition Switch Lamp	30
Ignition Time Delay Relay	30
Ignition System - Electronic Control Unit 5.9L 360 CID Federal, Canada, California And High Altitude Manual Transmission Engine	15-16
Air Switching Relief Valve Timer	16
Air Switching Solenoid	15
Ballast Resistor	16
Charge Temperature Switch	15
Distributor	15

Name	Wiring Diagram Sheet Number
Dual Pick-Up Relay	15
Electric Choke	15
Electric Choke Heater	15
Electronic Control Unit	16
Exhaust Gas Recirculation Solenoid Valve	16
Exhaust Gas Recirculation Vacuum Solenoid ...	15
Idle Stop Solenoid	15
Ignition Coil	15
Oil Pressure Sending Unit	15
Oil Pressure Switch	15
Temperature Sending Unit	15
Ignition System - Electronic Control Unit 5.9L 318 CID Light Duty Federal, Canada, California And High Altitude Automatic Transmission Engine	17-18
Air Switching Solenoid	17
Air Switch Recirculation Valve	18
Ballast Resistor	18
Charge Temperature Switch	17
Diode	18
Distributor	17
Dual Pick-Up Switch Relay	17
Electric Choke	17
Electric Choke Heater	17
Electronic Control Unit	18
Exhaust Gas Recirculation Solenoid Valve	18
Exhaust Gas Recirculation Vacuum Solenoid ...	17
Idle Stop Switch Relay	18
Idle Stop Switch Solenoid	17
Ignition Coil	17
Oil Pressure Sending Unit	17
Oil Pressure Switch	17
Temperature Sending Unit	17
Ignition System Electronic Control Unit 5.9L 360 CID Heavy Duty Engine	19-20
Ballast Resistor	20
Deceleration Throttle Control Solenoid	19
Distributor	19
Electric Choke	19
Electric Choke Heater	19
Electric Speed Switch	19
Electronic Control Unit	20
Ignition Coil	19
Oil Pressure Sending Unit	19
Oil Pressure Switch	19
Temperature Sending Unit	19
Ignition System - Electronic Fuel Injectors 3.9L And 5.2L Engine	11-12-13-14
Air Switching Solenoid	12
Auto Shutdown Relay	12
Diagnostic Connector	11
Distributor	14
Engine Coolant Sensor	14
Exhaust Gas Recirculation Solenoid	12
Heated Oxygen Sensor	11

Name	Wiring Diagram Sheet Number
Ignition Coil	12
Injectors	11
Map Sensor	14
Purge Solenoid	12
Single Module Engine Controller ...	11-12-13-14
Throttle Kicker Motor	13
Throttle Position Sensor	11
Instrument Panel Illumination Lamps	39-40
Instrument Panel To Steering Column	
25-Way Connector	67-68
Cavity 2	26-28-45
Cavity 3	26
Cavity 4	23-37
Cavity 5	24-37
Cavity 6	37
Cavity 7	37
Cavity 8	37
Cavity 9	37
Cavity 10	37
Cavity 12	45-47
Cavity 13	45-47
Cavity 14	45-47
Cavity 15	45-47
Cavity 16	45-47
Cavity 17	26-28-45
Cavity 18	46
Cavity 19	30
Cavity 20	30
Cavity 24	30
Cavity 25	26-28-30-45
Intermittent Wipe System	45-46
Circuit Breaker-Wiper Motor	46
Control Unit	46
Fuse	46
Park Switch	46
Switch	45
Washer Motor	45
Washer Pump	45
Washer Switch	45
Wiper Motor	46
Wiper Switch	45
Key-In Combined Buzzer	59
Key-In Lamp	30
Key-In Switch	30
Key-In Warning Buzzer	59
Lamp Diode	29
Lamps	
Air Conditioning and Heater Switch Lamp	28
Ash Receiver	28-31
Back-Up Lamps	61-62
Brake Warning Indicator Lamp	40
Cargo Lamp	30
Cargo Lamp Indicating Lamp	30
Clearance Lamps	35-36
Cluster Illumination Lamps	39-40

Name	Wiring Diagram Sheet Number
Courtesy Lamps Rear	29
Dome Lamp	30
Emission Maintenance Reminder Lamp	39
Four Wheel Drive Indicator	54
Front Dome Lamp	30
Front Headlamp-Left	23
Front Headlamp-Right	24
Front Headlamps-Snow Plow	32
Front Parking Lamp-Left	23
Front Parking Lamp-Right	24
Front Parking Lamp-Snow Plow	32
Front Reading Lamp	30
Front Turn Signal Lamps-Left	23
Front Turn Signal Lamps-Right	24
Front Turn Signal Lamps-Snow Plow	32
Four Wheel Drive Indicator	25-53
Glove Box Lamp	31
Headlamp-Left	23
Headlamp-Right	24
Headlamp-Snow Plow	32
Headlamp Switch	28
Headlamp Switch Controlled Interior Lamps ...	27
Headlamp Switch Title Lamp	28
Heater A/C Switch Illumination	28
Heater Switch Lamp	28
High Beam Indicator Lamp	39
Identification Lamps	35-36
Ignition Switch Lamp	30
Instrument Panel Illumination Lamps	39
Left Back-Up Lamp	61
Left Front Parking Lamp	23
Left Front Snow Plow Lamps	32
Left Front Turn Signal Lamp	23
Left Headlamp	23
Left Rear Stop Lamp	61
Left Rear Tail Lamp	61
Left Rear Turn Signal Lamp	61
Left Turn Signal Indicator Lamp	39
License Lamp	62
Liftgate Ajar Lamp	29
Low Oil Pressure Lamp	39
Map Lamp	30
Oil Pressure Warning Lamp	39
Oil Temperature-Transmission	33
Parking Brake Warning Lamp	39
Parking Lamp-Left	23
Parking Lamp-Right	24
Parking Lamps-Snow Plow	32
Reading Lamps	30
Rear Back-Up Lamp-Left	61
Rear Back-Up Lamp-Right	62
Rear Courtesy Lamps	29
Rear Dome Lamp	29
Rear End Lighting System	61-62
Rear License Lamp	62

Name	Wiring Diagram Sheet Number
Rear Stop Lamp-Left	61
Rear Stop Lamp-Right	62
Rear Tail Lamp-Left	61
Rear Tail Lamp-Right	62
Right Front Parking Lamp	24
Right Front Snow Plow Lamps	32
Right Front Turn Signal Lamp	24
Right Headlamp	24
Right Parking Lamp	24
Right Rear Stop Lamp	62
Right Side Marker Lamp	62
Right Turn Signal Indicator Lamp	39
Seat Belt Warning Lamp	39
Side Marker Lamp Left Front	23
Side Marker Lamp Right Front	24
Snow PLOW Switch Illumination	28
Stop Lamp-Left Rear	61
Stop Lamp-Right Rear	62
Switch Illumination A/C Heater	28
Switch Illumination Heater	28
Switch Illumination Headlamp	28
Switch Illumination-Ignition Switch	30
Switch Illumination-Snow Plow	28
Tail Lamp-Left Rear	61
Tail Lamp-Right Rear	62
Temperature Indicating	39
Transmission Oil Temperature	33
Turn Signal Indicator Lamps	39
Turn Signal Lamp-Left Front	23
Turn Signal Lamp-Right Front	24
Turn Signal Lamp-Left Rear	61
Turn Signal Lamp-Right Rear	62
Turn Signal Lamps-Snow Plow	32
Left Back-Up Lamp	61
Left Door Electric Lock Motor	55
Left Door Electric Lock Switch	55
Left Door Jamb Switch	30
Left Door Stereo Radio Speaker	44
Left Door Window Lift Motor	54
Left Door Window Lift Switch	54
Left Front Electric Door Lock Motor	55
Left Front Electric Window Lift Motor	54
Left Front Headlamp	23
Left Front Parking Lamp	23
Left Front Snow Plow Lamps	32
Left Front Turn Signal Lamp	23
Left Printed Circuit Board	39
Left Printed Circuit Board Connector	39
Left Rear Back-Up Lamp	61
Left Rear Stereo Radio Speaker	43
Left Rear Stop Lamp	61
Left Rear Tail Lamp	61
Left Rear Turn Signal Lamp	61
Limiter-Voltage	39
License Lamp	62

Name	Wiring Diagram Sheet Number
Liftgate Ajar Lamp	29
Liftgate Ajar Switch	29
Lighter-Cigar	31
Low Oil Pressure Gauge	39
Low Oil Pressure Gauge Sending Unit With ECU Ignition	15-17-18-21
Low Oil Pressure Gauge Sending Unit With EFI Ignition	22
Low Oil Pressure Lamp	39
Low Oil Pressure Lamp Switch With ECU Ignition	15-17-19-21
Low Oil Pressure Lamp Switch With EFI Ignition .	22
Map Lamp	30
Map Lamp Switch	30
Message Center	40
Brake Warning Indicator Lamp	40
Check Engine Lamp	40
Mirrors-Power	57-58
Fuse	57
Left Horizontal Motor	57
Left Vertical Motor	57
Right Horizontal Motor	58
Right Vertical Motor	58
Switch	58
Modules	
Buzzer	59
Headlamp On	59
Intermittent Wipe	46
Key-In	59
Overdrive Transmission	9
Seat Belt Warning	59-60
Motors	
Blower-A/C With ECU Ignition	49
Blower-A/C With EFI Ignition	51
Blower-Heater	48
Intermittent Wipe Washer	45
Intermittent Wipe Windshield Wiper	46
Power Door Locks-Left	55
Power Door Locks-Right	56
Power Mirror	58
Power Window-Left	54
Power Window-Right	54
Snow Plow	34
Standard Wipe Washer	47
Standard Wipe Windshield Wiper	46
Starter With ECU Ignition	8
Starter With EFI Ignition	7
Monaural Radio	41
Monaural Radio Speaker	41
Neutral Start Switch With ECU Ignition	8
Neutral Start Switch With EFI Ignition	7
Oil Pressure Sending Unit With ECU Ignition	15-17-19-21
Oil Pressure Sending Unit With EFI Ignition	22
Oil Pressure Switch With ECU Ignition	15-17-19-21

Name	Wiring Diagram Sheet Number
Oil Pressure Switch With EFI Ignition	22
Oil Pressure Warning Lamp	39
Overdrive Transmission	9
Control Module	9
Fuse	9
Ground	9
Solenoid	9
Switch	9
Oxygen Sensor With EFI Ignition System	11
Parking Brake Warning Lamp	40
Parking Brake Warning Lamp Switch	21
Parking Lamp Left Front	23
Parking Lamp Right Front	24
Part Throttle Unlock Relay With EFI Ignition	7
Part Throttle Unlock Solenoid With EFI Ignition ..	7
Power Door Lock System	55-56
Circuit Breaker	55
Left Front Door Motor	55
Left Front Door Switch	55
Right Front Door Motor	56
Right Front Door Switch	55
Power Mirrors	57-58
Fuse	57
Left Horizontal Motor	57
Left Vertical Motor	57
Right Horizontal Motor	58
Right Vertical Motor	58
Switch	58
Power Window System	54
Circuit Breaker	54
Left Door Switch	54
Left Motor	54
Right Door Switch	54
Right Motor	54
Printed Circuit Board Connectors	
Left	23-27-28-37-39-59-60
Right ..	16-18-20-21-22-24-25-28-37-39-59-60
Pump Intermittent Washer	45
Pump Standard Washer	47
Radio-AM Monaural	41
Radio-AM/FM Stereo	42
Radio-AM/FM Stereo Cassette	43
Radio Speaker AM Monaural	41
Radio Speakers AM/FM Stereo or Cassette	42-43-44
Rear Dome Lamp	30
Rear Dome Lamp Switch	30
Rear Cargo Lamp	30
Rear Cargo Lamp Switch	30
Rear Courtesy Lamps	29
Rear Lighting System	61-62
Regulator-Voltage With ECU Ignition	5
Relays	
Auto Shutdown With EFI Ignition	12
Dual Pick-up With ECU Ignition	15-17

Name	Wiring Diagram Sheet Number
Horn	26
Idle Stop Switch With ECU Ignition	18
Ignition Time Delay	30
Part Throttle Unlock Relay	7
Part Throttle Unlock Solenoid	7
Starter Motor With ECU Ignition	8
Starter Motor With EFI Ignition	7
Time Delay	30
Wide Open Throttle Cut-Out With EFI Ignition	52
Resistor Ballast	30
Resistor Block A/C and Heater With ECU Ignition	49
Resistor Block A/C Heater With EFI Ignition	51
Resistor Block Heater	48
Right Back-Up Lamp	62
Right Cargo Door Switch	30
Right Door Electric Lock Motor	56
Right Door Electric Lock Switch	56
Right Door Stereo Radio Speaker	45
Right Door Window Lift Motor	54
Right Front Door Lamp Switch	30
Right Front Electric Door Lock Motor	54
Right Front Electric Window Lift Motor	54
Right Front Headlamp	24
Right Front Parking Lamp	24
Right Front Snow Plow Lamps	32
Right Front Turn Signal Lamp	24
Right Printed Circuit Board	39
Right Printed Circuit Board Connector	39
Right Rear Back-Up Lamp	62
Right Rear Stereo Radio Speaker	44
Right Rear Stop Lamp	62
Right Rear Tail Lamp	62
Right Rear Turn Signal Lamp	62
Safety Neutral Switch With ECU Ignition	8
Safety Neutral Switch With EFI Ignition	7
Seat Belt Warning System	59-60
Seat Belt Warning Buzzer	59-60
Seat Belt Warning Buzzer Switch	59-60
Seat Belt Warning Lamp	39
Time Delay Relay	30
Sensors	
Distance With EFI Ignition	14
Engine Coolant With EFI Ignition	14
Oxygen With EFI Ignition	11
Map With EFI Ignition	14
Temperature Sending-Engine ...	15-17-19-21-22
Throttle Position with EFI Ignition	11
Servo Speed Control	25
Side Marker Lamp Left Front	23
Side Marker Lamp Right Front	24
Single Module Engine Controller	
14-Way Connector	64
Cavity 1	14
Cavity 2	11

Name	Wiring Diagram Sheet Number	Name	Wiring Diagram Sheet Number
Cavity 3	12	Motor	34
Cavity 4	12	Right Solenoid	34
Cavity 5	12	Solenoid-Down	34
Cavity 6	11	Solenoid-Left	34
Cavity 7	11	Solenoid-Right	34
Cavity 8	12	Solenoid-Up	34
Cavity 9	11	Switch Illumination	28
Cavity 10	11	Switch-Up-Down	33
Cavity 11	12	Switch-Left-Right	33
Cavity 12	12	Transmission Oil Temperature Lamp	33
Cavity 13	13	Transmission Oil Temperature Switch	34
Cavity 14	13	Up-Down Switch	33
Single Module Engine Controller		Up Solenoid	33
60-Way Connector	63	Snow Plow Lamps	32
Cavity 1	14	Dimmer Switch	27
Cavity 3	14	Headlamps	32
Cavity 4	14	Headlamp Switch	32
Cavity 5	11	Left Headlamp	32
Cavity 10	12	Left Parking Lamp	32
Cavity 12	12	Left Turn Signal Lamp	32
Cavity 13	14	Right Headlamp	32
Cavity 14	12	Right Parking Lamp	32
Cavity 15	11	Right Turn Signal Lamp	32
Cavity 16	11	Switch Illumination Lamp	28
Cavity 17	13	Solenoids	
Cavity 19	13	Air Switching With ECU Ignition	15-17
Cavity 22	11	Air Switching With EFI Ignition	12
Cavity 23	11	Deceleration Throttle Control	19
Cavity 26	13	Exhaust Gas Recirculation With	
Cavity 29	13	ECU Ignition	15-17
Cavity 30	13	Exhaust Gas Recirculating With EFI Ignition ...	12
Cavity 31	11	Idle Stop Switch With ECU Ignition	15-17
Cavity 32	12	Overdrive Transmission	9
Cavity 33	12	Oxygen Feedback With EFI Ignition	11
Cavity 34	13	Part Throttle Unlock With EFI Ignition	7
Cavity 38	13	Purge With EFI Ignition	12
Cavity 39	11	Snow Plow	34
Cavity 40	12	Speaker-Monaural	41
Cavity 41	13	Speaker Stereo	42-43-44
Cavity 45	11	Speed Control System	25
Cavity 47	14	Brake Warning Lamp Switch	25
Cavity 48	14	Clutch Switch	25
Cavity 51	11	Control Switch	25
Cavity 52	14	Fuse	25
Cavity 54	12	Servo	25
Cavity 55	13	Stop Lamp Switch	25
Cavity 56	11	Splices	
Cavity 58	11	Splice A1	1-3-5-34
Cavity 59	13	Splice C4	49-51
Snow Plow Controls	33	Splice C7	49-51
Down Solenoid	34	Splice C13	4-6
Ground	34	Splice C20	50
Fuse	33	Splice D1	33
Left-Right Switch	33	Splice D5	24
Left Solenoid	34	Splice D6	23

Name	Wiring Diagram Sheet Number
Splice E2	28-31-41-42-43
Splice G5 .. 5-10-16-18-25-26-29-40-53-59-60	
Splice H2	26
Splice H4-1 9-26-27-28-30-45-46-54-55-57-59-60	
Splice H4-2	9-26-28-30-31-49-51
Splice H4-3	59-60
Splice J2	4-9-12
Splice J2-2	4-6-12-13-15-17-19-21-52
Splice J2-3 . 4-5-8-12-16-18-20-21-25-53-59-60	
Splice J9	11-13
Splice J9-1 .. 7-8-17-25-45-47-48-49-51-53-59-60-61	
Splice K5	11-13
Splice K5-1	11-13
Splice K8	11-14
Splice K14	12
Splice L1	4-6-25-26-27-31-55
Splice L7	25-61
Splice L7-1	23-27-35-36-41-42-43-61
Splice L7-2	23-27-35-61
Splice L9-1	23-47
Splice M1	4-9-30-31-41-42-43-57
Splice M2	27-29-30
Splice N5	11-14
Splice N5-1	11-14
Splice N6	14
Splice P5	21
Splice R6-1	1-2-4-6
Splice R6-3	4
Splice R9	3-5-50-52
Splice S5	7-8
Splice W1	54
Splice W8	54
Splice X2	59
Splice X2-1	60-62
Splice X2-2	59-60-61
Splice X2-3	61
Splice X33-1	56
Splice X34-1	56
Splice X55	42
Splice X56	42
Splice Y5	16-18-20
Splice Z1	12
Standard Windshield Wiper	47
Circuit Breaker-Wiper Motor	47
Fuse	47
Washer Motor	47
Washer Pump	47
Wiper Motor	47
Wiper Switch	47
Starter System With ECU Ignition System	8
Back-Up Lamp Switch	8
Fuse	8
Motor	8
Neutral Start Switch	8

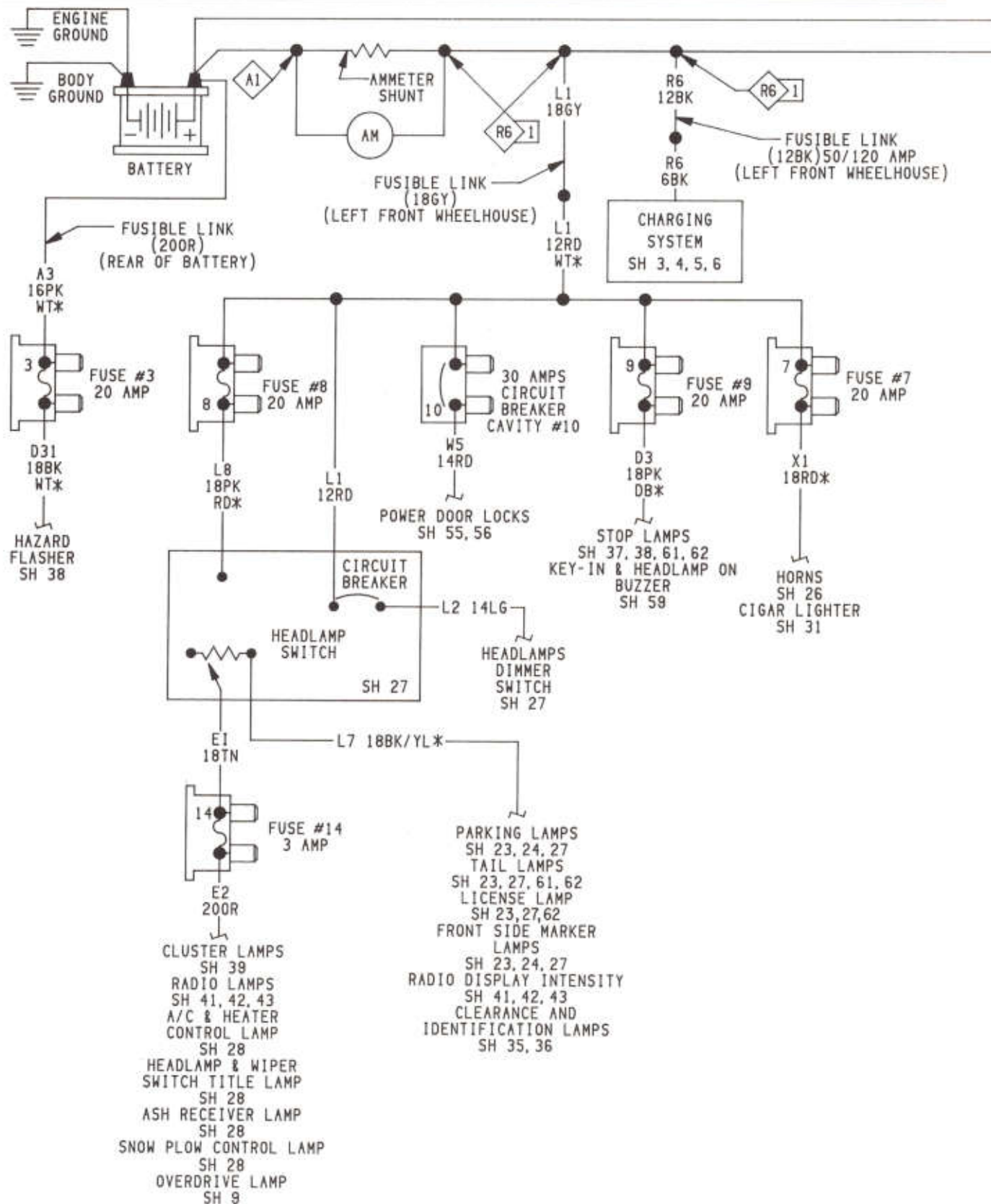
Name	Wiring Diagram Sheet Number
Relay	8
Starter System With EFI Ignition	7
Back-Up Lamp Switch	7
Fuse	7
Motor	7
Neutral Start Switch	7
Part Throttle Unlock Solenoid	7
Relay	7
Safety Neutral Switch	7
Steering Column To Instrument Panel	
25-Way Connector	67-68
Cavity 2	26-28-45
Cavity 3	26
Cavity 4	23-37
Cavity 5	24-37
Cavity 6	37
Cavity 7	37
Cavity 8	37
Cavity 9	37
Cavity 10	37
Cavity 12	45-47
Cavity 13	45-47
Cavity 14	45-47
Cavity 15	45-47
Cavity 16	45-47
Cavity 17	26-28-45
Cavity 18	46
Cavity 19	30
Cavity 20	30
Cavity 24	30
Cavity 25	26-28-30-45
Stereo Radio	42-43
Stereo Radio Speakers	44
Stop Lamps	61-62
Stop Lamp Switch	28-38
Switches	
A/C Clutch With ECU Ignition	50
A/C Clutch With EFI Ignition	52
A/C Damped Pressure With ECU Ignition	50
A/C Damped Pressure Switch With EFI Ignition	52
A/C Heater Blower With ECU Ignition	49
A/C Heater Blower With EFI Ignition	51
A/C Vacuum With ECU Ignition	49
A/C Vacuum With EFI Ignition	51
Automatic Transmission Neutral Start With ECU Ignition	8
Automatic Transmission Neutral Start With EFI Ignition	7
Back-Up Lamp with ECU Ignition	8
Back-Up Lamp With EFI Ignition	7
Blower A/C Heater With ECU Ignition	49
Blower A/C Heater With EFI Ignition	51
Blower Heater With ECU Ignition	51
Blower Heater With EFI Ignition	51
Blower A/C Heater With EFI Ignition	51

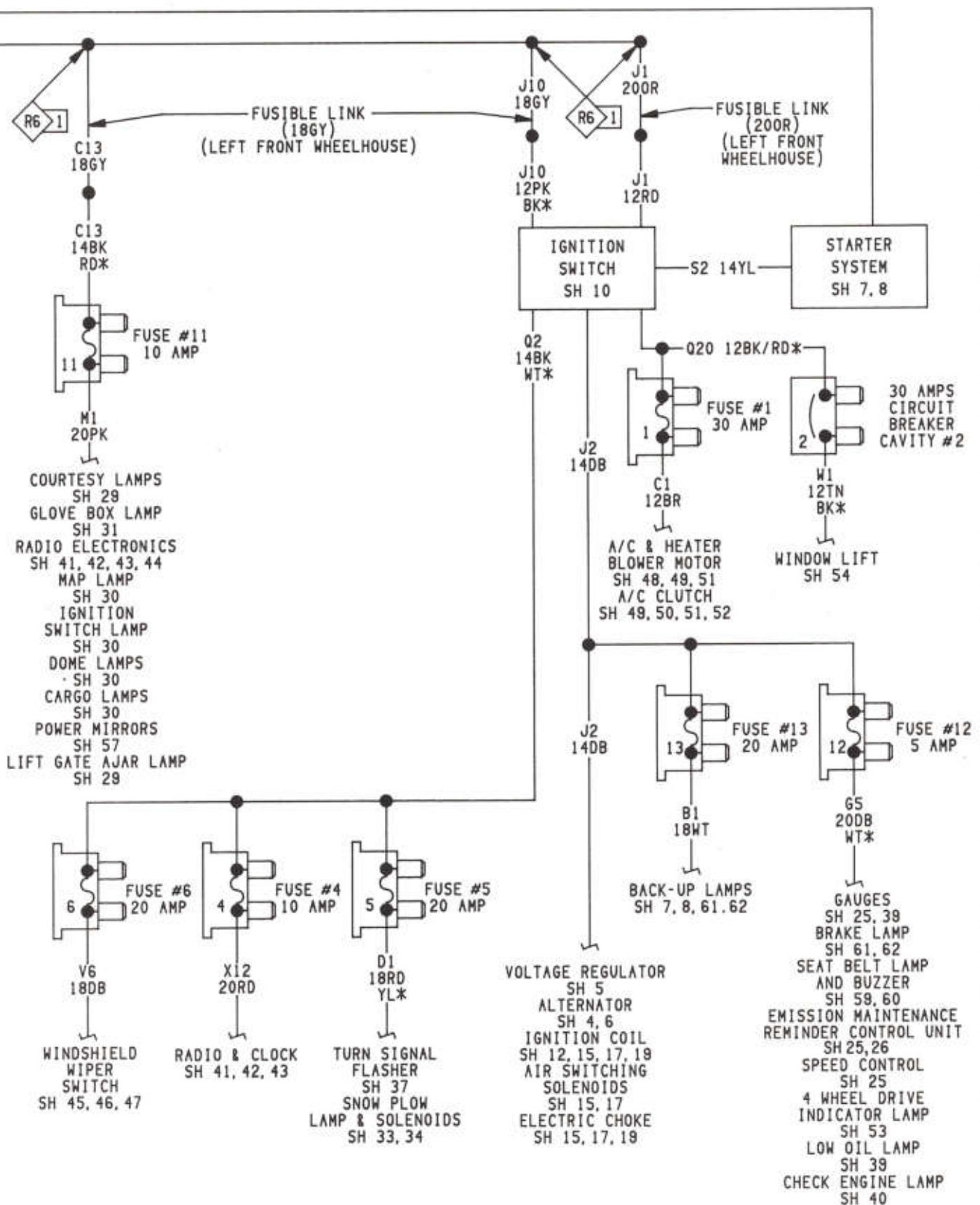
Name	Wiring Diagram Sheet Number
Brake Stop Lamp	25-38
Brake Warning Lamp	21
Carburetor Idle Stop	15-17-19
Cargo Lamp	30
Charge Temperature	15-17
Clutch-A/C Cut-out With ECU Ignition	50
Clutch-A/C Cut-out With EFI Ignition	52
Control-A/C With ECU Ignition	49
Control-A/C With EFI Ignition	50
Control Speed	25
Courtesy Lamp	29
Cut-Out-A/C Clutch With ECU Ignition	50
Cut-Out-A/C Clutch With EFI Ignition	52
Dimmer-Headlamp	27
Dome Lamp-Front	30
Dome Lamp-Rear	30
Door Jamb	30
Door Lock-Electric-Left	55
Door Lock-Electric-Right	56
Door Windows Electric-Left	54
Door Windows Electric-Right	54
Electric Door Locks-Left	55
Electric Door Locks-Right	56
Electric Windows	54
Electronic Speed Control	25
Electronic Speed With ECU Ignition	19
Front Dome Lamp	30
Front Reading Lamp	30
Four Wheel Drive Indicator	54
Glove Box Lamp	31
Hazard Warning	38
Headlamp	27
Headlamp Dimmer	27
Heater Blower	48
Horn	26
Idle Stop	15-17
Ignition	10
Illumination Lamp-A/C Switch	28
Illumination Lamps-Instrument Panel	39
Intermittent Wipe	45
Intermittent Wipe Park	46
Key-In	30
Left Front Door Jamb	30
Lift Gate Ajar	29
Low Pressure-A/C With ECU Ignition	50
Low Pressure-A/C With EFI Ignition	52
Low Pressure-Oil With ECU Ignition	15-17-19-21
Low Pressure Oil With EFI Ignition	22
Map Lamp	30
Mirror Power	38
Neutral Start With ECU Ignition	8
Neutral Start With EFI Ignition	7
Oil-Low Pressure Switch With ECU Ignition	15-17-19-21
Oil-Low Pressure Switch With EFI Ignition	22

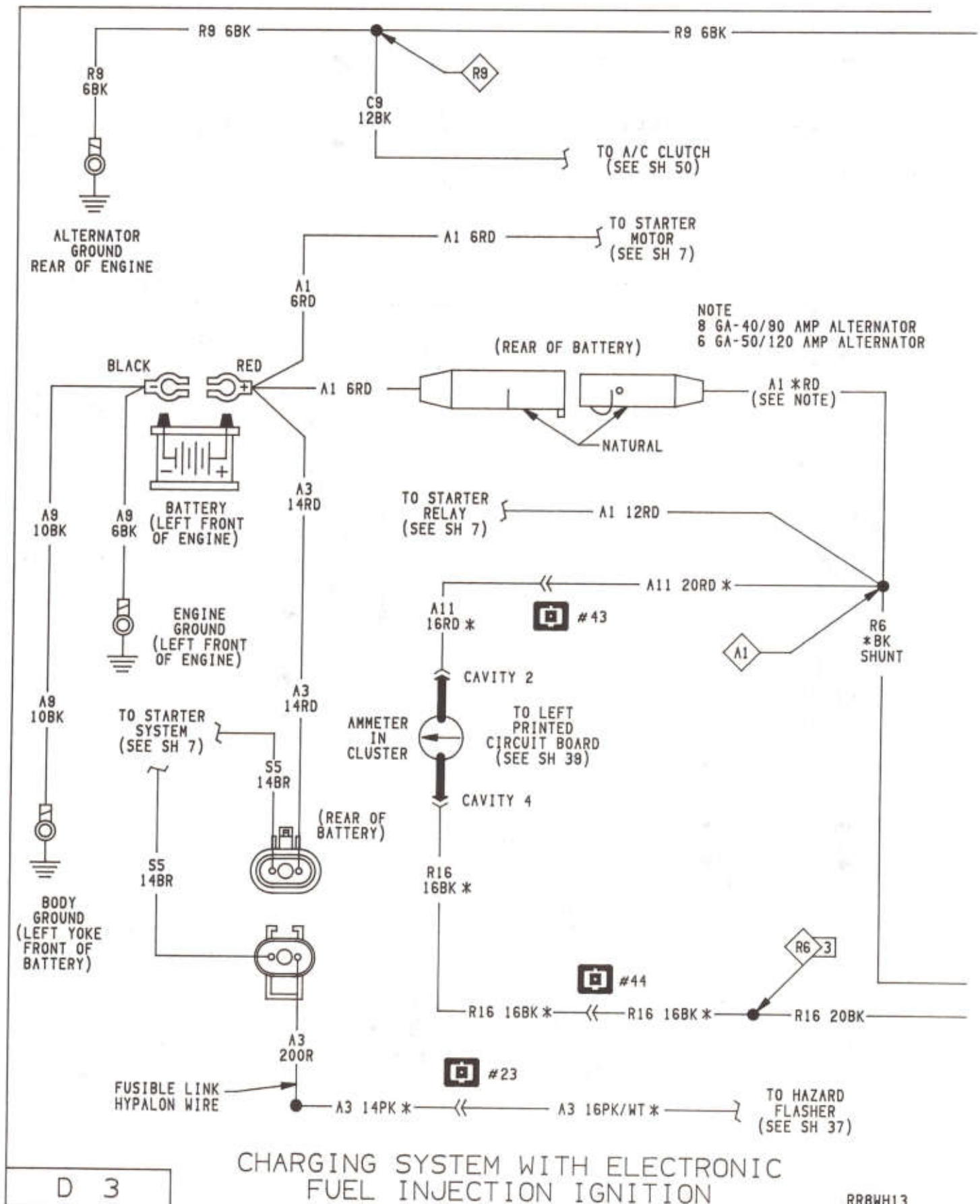
Name	Wiring Diagram Sheet Number
Oil-Low Pressure Sending Unit With ECU Ignition	15-17-19-21
Oil-Low Pressure Sending Unit With EFI Ignition	22
Overdrive Transmission	
Park Brake Warning	21
Park Switch-Intermittent Wipe	46
Park Switch-Standard Wipe	47
Power Door Locks-Left	55
Power Door Locks-Right	56
Power Mirrors	58
Power Windows	54
Rear Cargo Lamp	30
Rear Dome Lamp	30
Right Door Lock	56
Right Front Door Jamb	30
Safety Neutral With ECU Ignition	8
Safety Neutral With EFI Ignition	7
Seat Belt Warning With ECU Ignition	59
Seat Belt Warning With EFI Ignition	60
Snow Plow	33
Speed Control	25
Speed Control Brake	25
Speed Control Clutch	25
Standard Windshield Wiper	47
Stop Lamp	25-38
Temperature With ECU Ignition	15-17-19-21
Temperature With EFI Ignition	22
Transfer Case Switch	53
Transmission Oil Temperature	34
Turn Signal	37
Vacuum Switch-A/C With ECU Ignition	49
Vacuum Switch-A/C With EFI Ignition	51
Voltage Limiter	39
Window Lift-Left	54
Window Lift-Right	54
Windshield Washer Intermittent Wipe	45
Windshield Washer-Standard	47
Windshield Wiper-Intermittent	45
Windshield Wiper Intermittent Park Switch	46
Windshield Wiper-Standard	47
Windshield Wiper-Standard Park Switch	47
Tail Lamps	61-62
Temperature Gauge	39
Temperature Indicator Lamp	39
Temperature Sending Unit With ECU Ignition	15-17-19-21
Temperature Sending Unit With EFI Ignition	21
Time Delay Buzzer	59-60
Time Delay Relay	30
Timer Emission Maintenance	26
Transfer Case Indicator Switch	53
Transmission Oil Temperature Lamp	33
Transmission Oil Temperature Switch	34
Transmission Part Throttle Unlock Relay	7

Name	Wiring Diagram Sheet Number
Transmission Part Throttle Unlock Solenoid	7
Turn Signal System	37-38
Flasher	37
Fuse	37
Lamps-Front	23-24
Lamps-Rear	61-62
Switch Control	37
Switch Stop	38
Voltage Limiter	39
Voltage Regulator	5
Warning Flasher Hazard	37
Warning Flasher Turn Signal	37
Window Lifts Electric	54
Circuit Breaker	54
Motors	54
Switch	54
Windshield Wiper-Intermittent	45-46
Circuit Breaker-Wiper Motor	46

Name	Wiring Diagram Sheet Number
Control Unit	46
Park Switch	46
Switch	45
Washer Motor	45
Washer Pump	45
Washer Switch	45
Wiper Motor	46
Wiper Switch	45
Windshield Wiper-Standard	47
Circuit Breaker-Wiper Motor	47
Fuse	47
Park Switch	47
Washer Motor	47
Washer Pump	47
Washer Switch	47
Wiper Motor	47
Wiper Switch	47

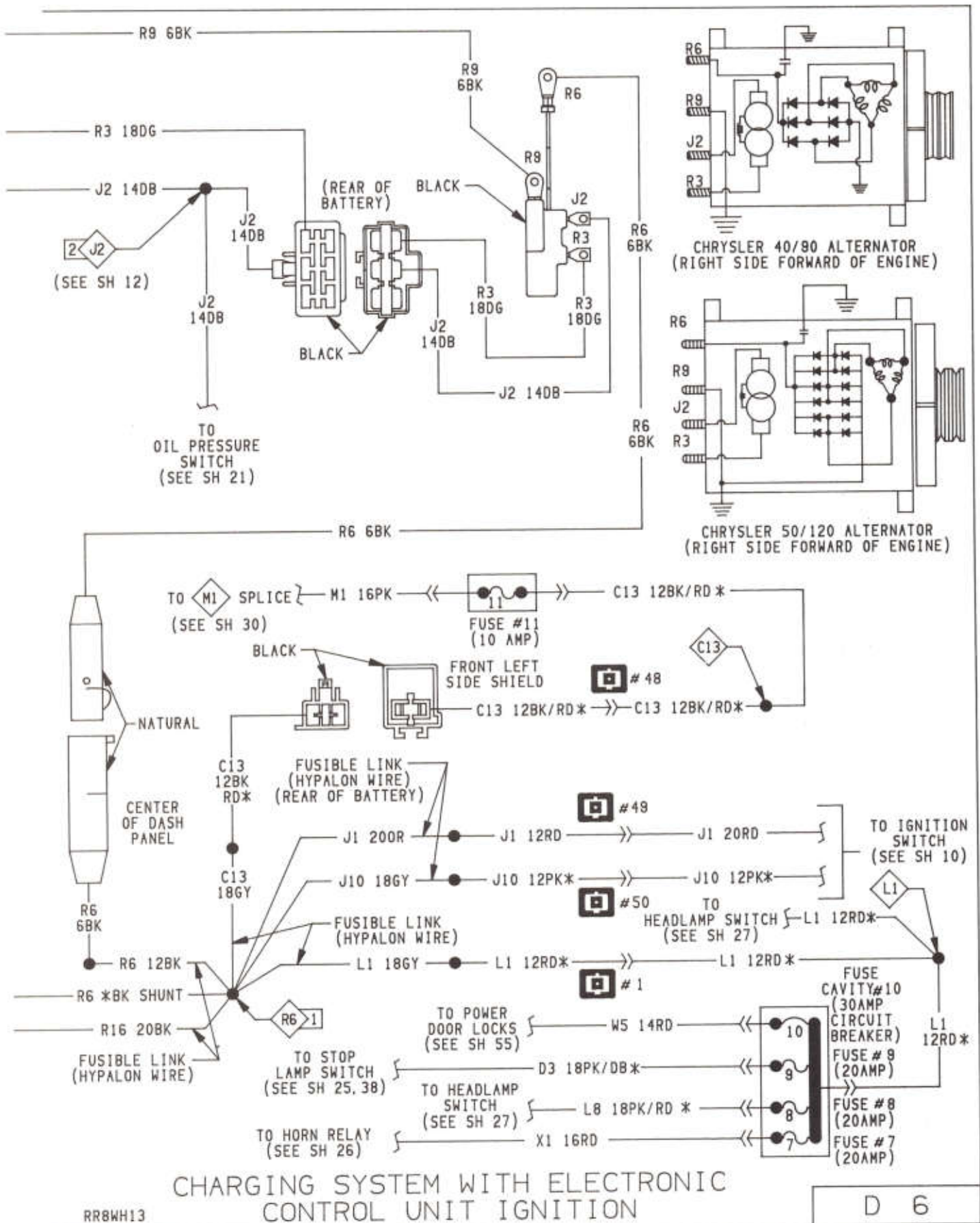




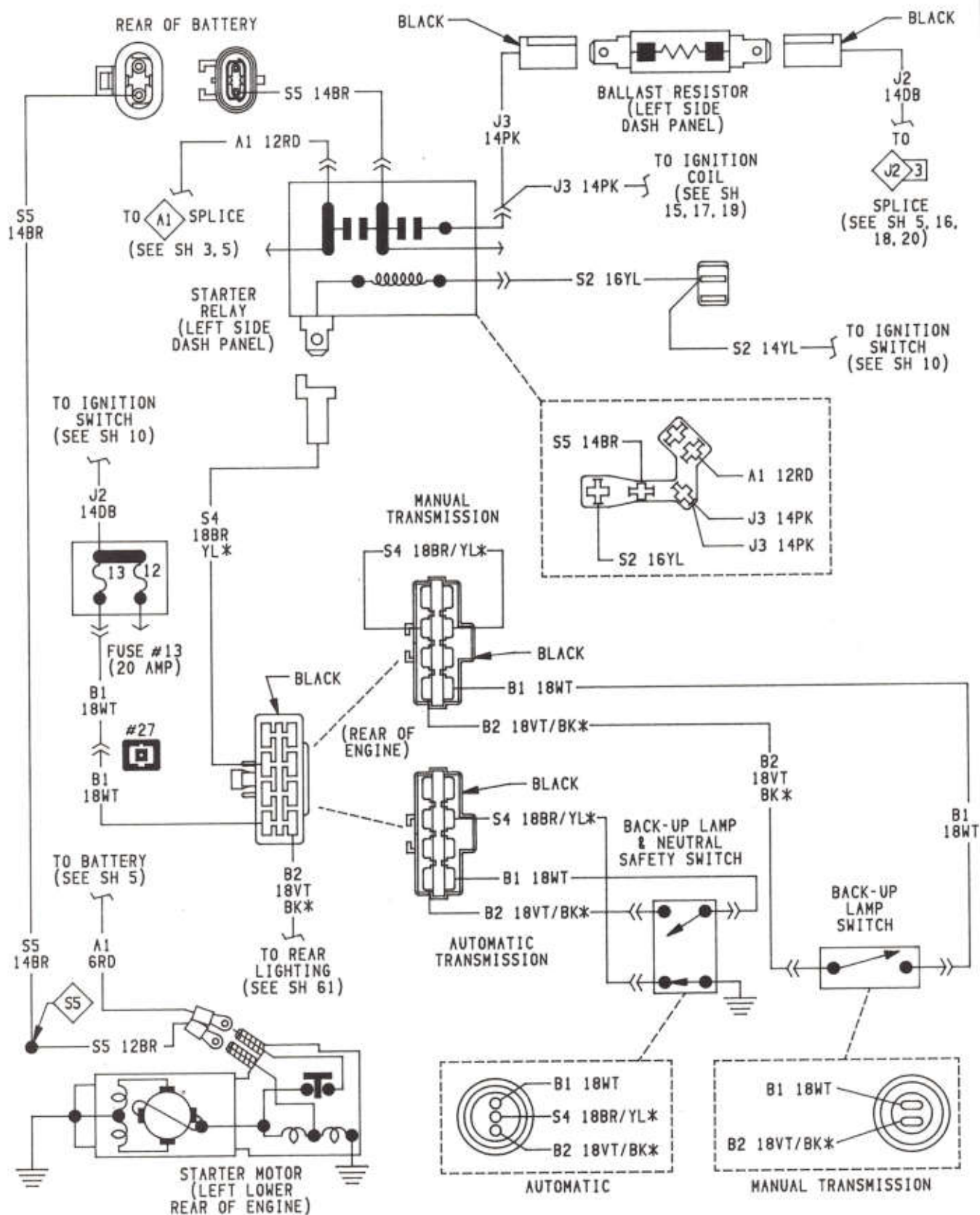








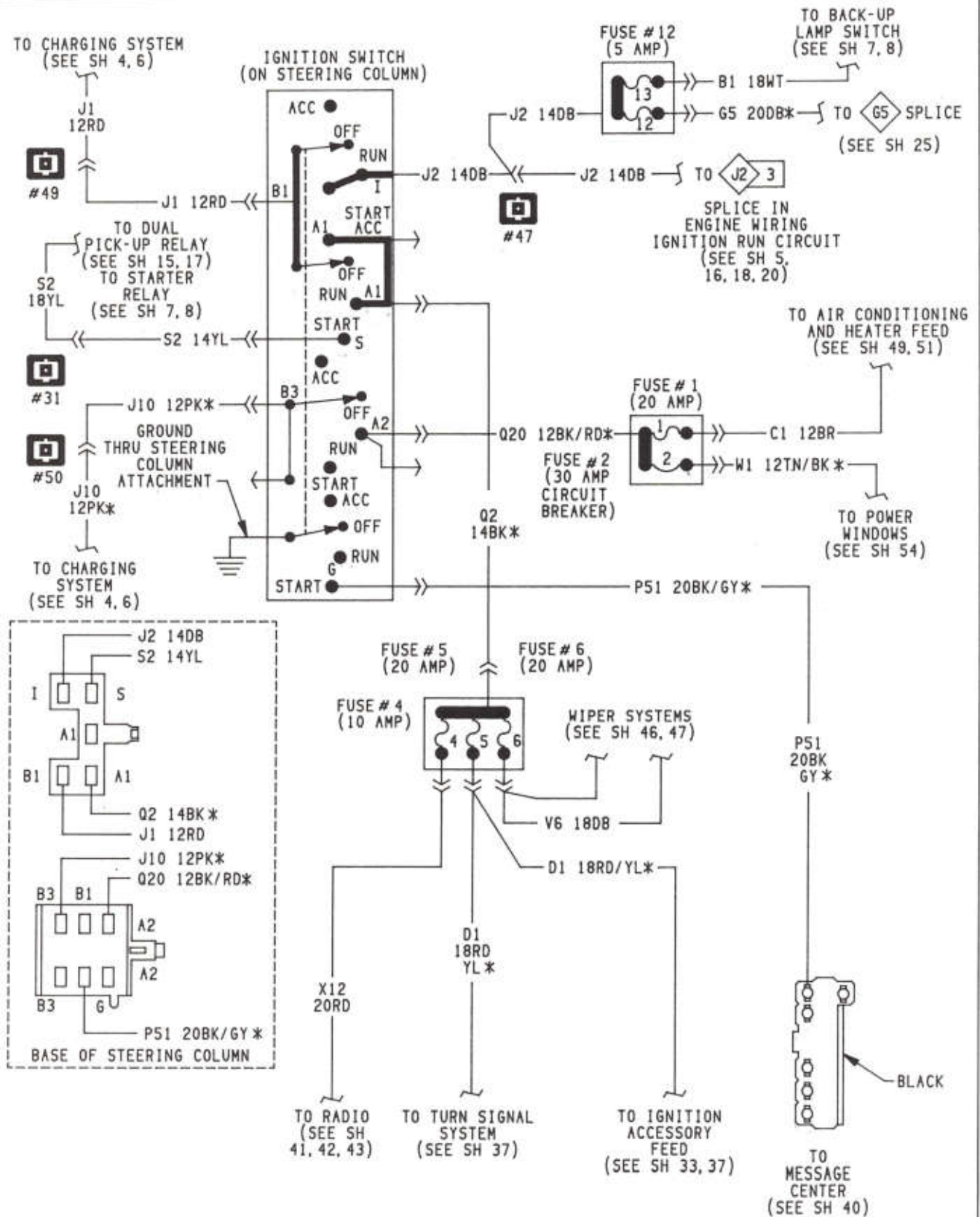


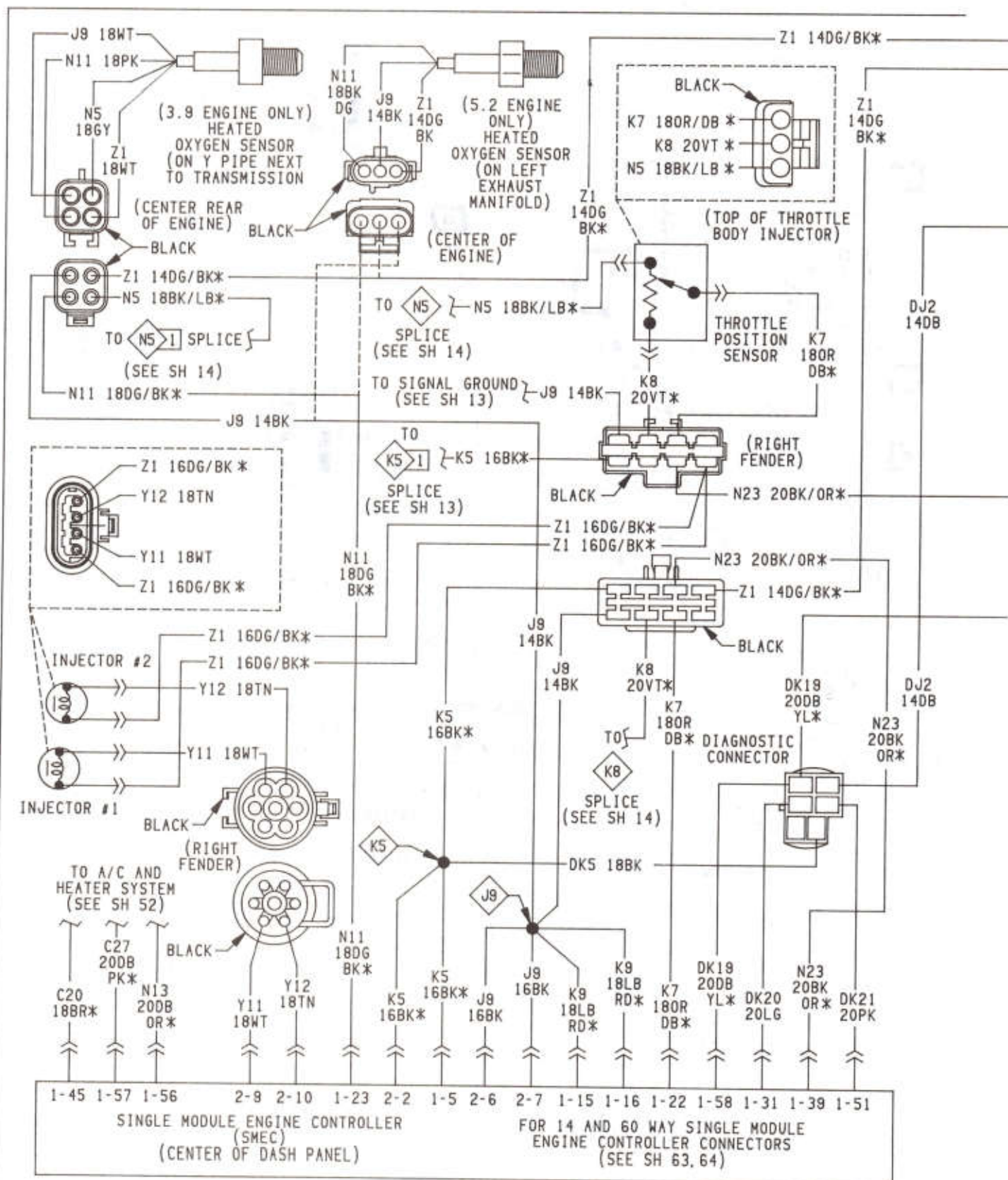


STARTER SYSTEM-ELECTRONIC
CONTROL UNIT IGNITION



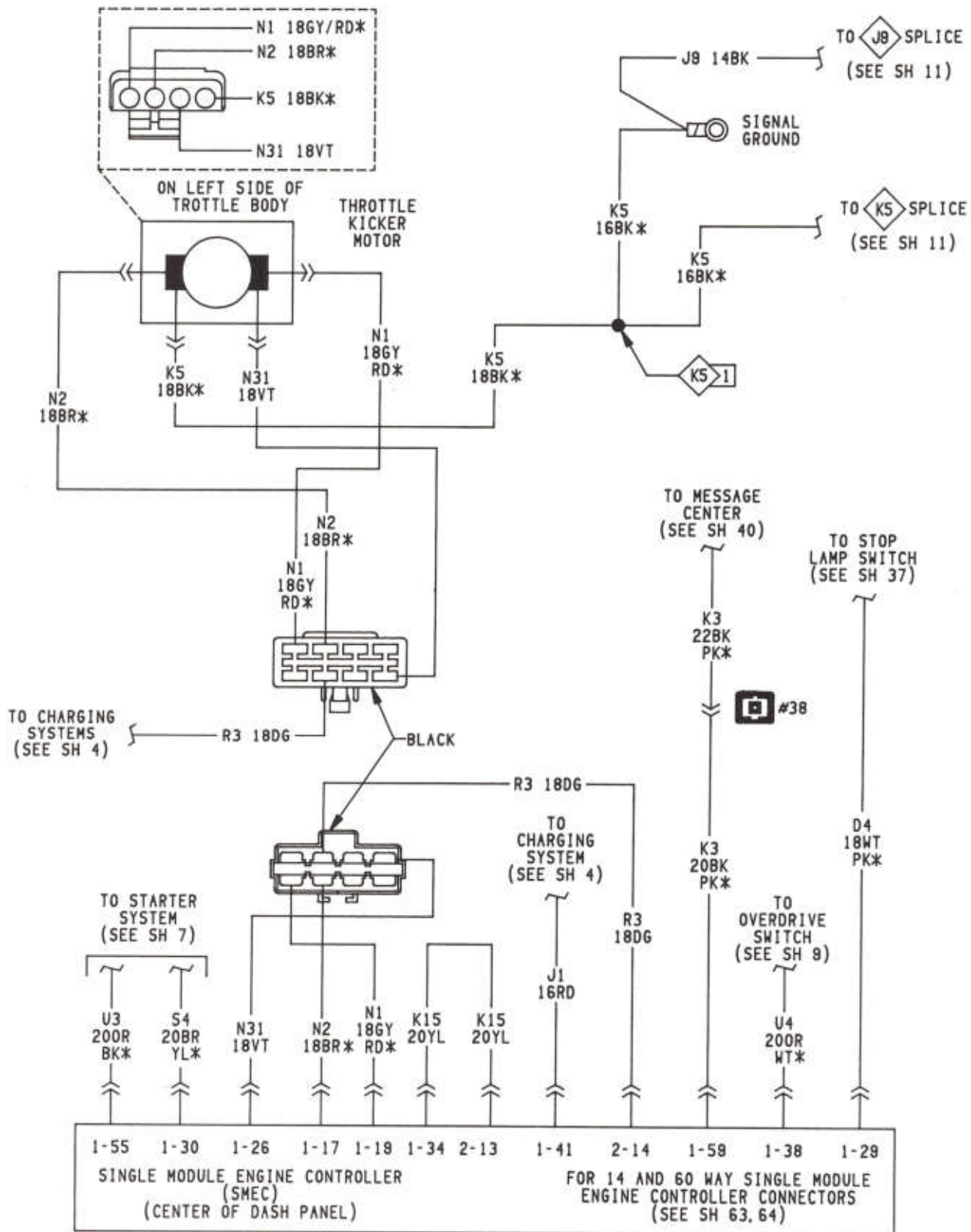
RR8WH13

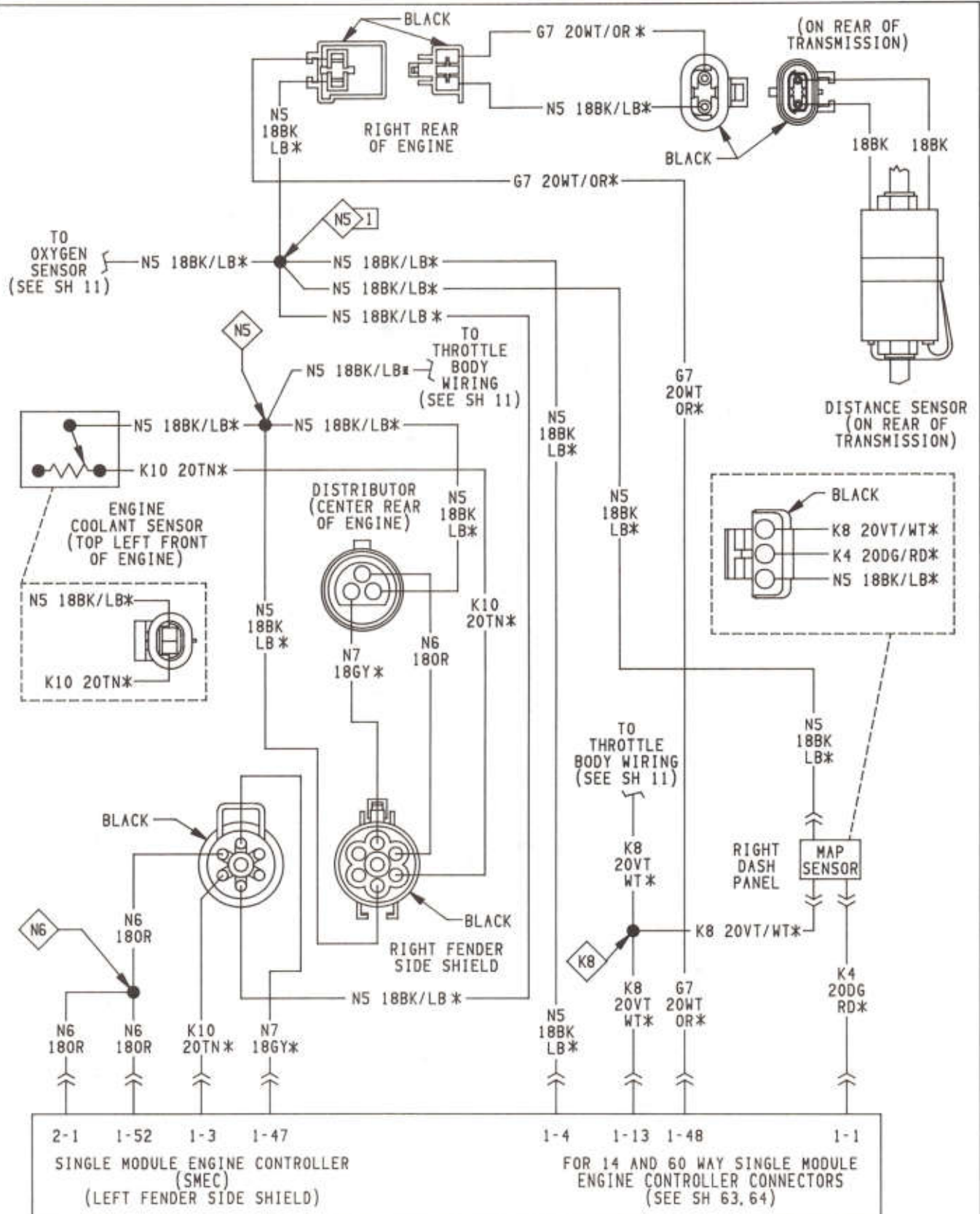




3.9 & 5.2L ELECTRONIC FUEL INJECTION IGNITION SYSTEM



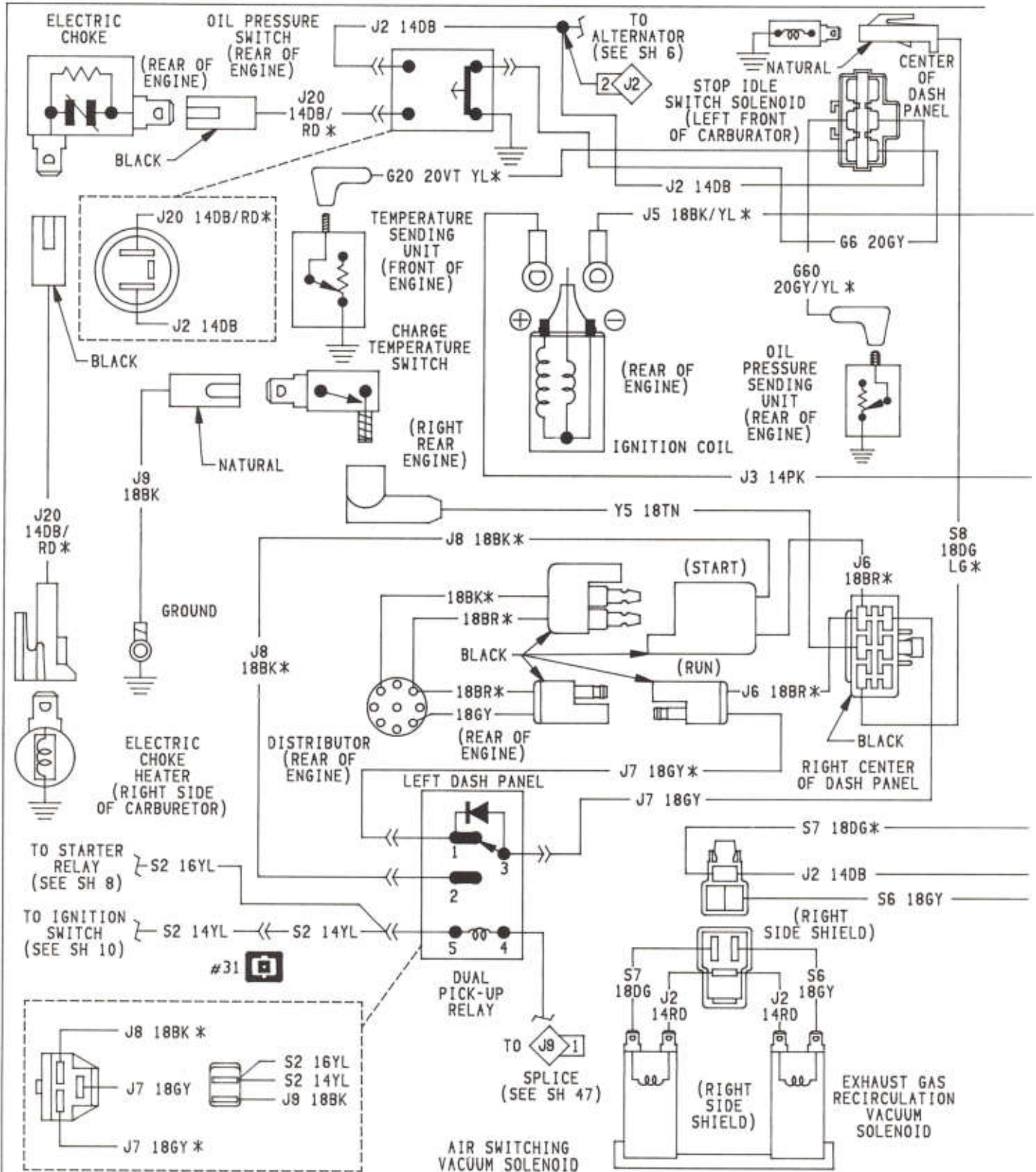




3.9 & 5.2L ELECTRONIC FUEL INJECTION IGNITION SYSTEM

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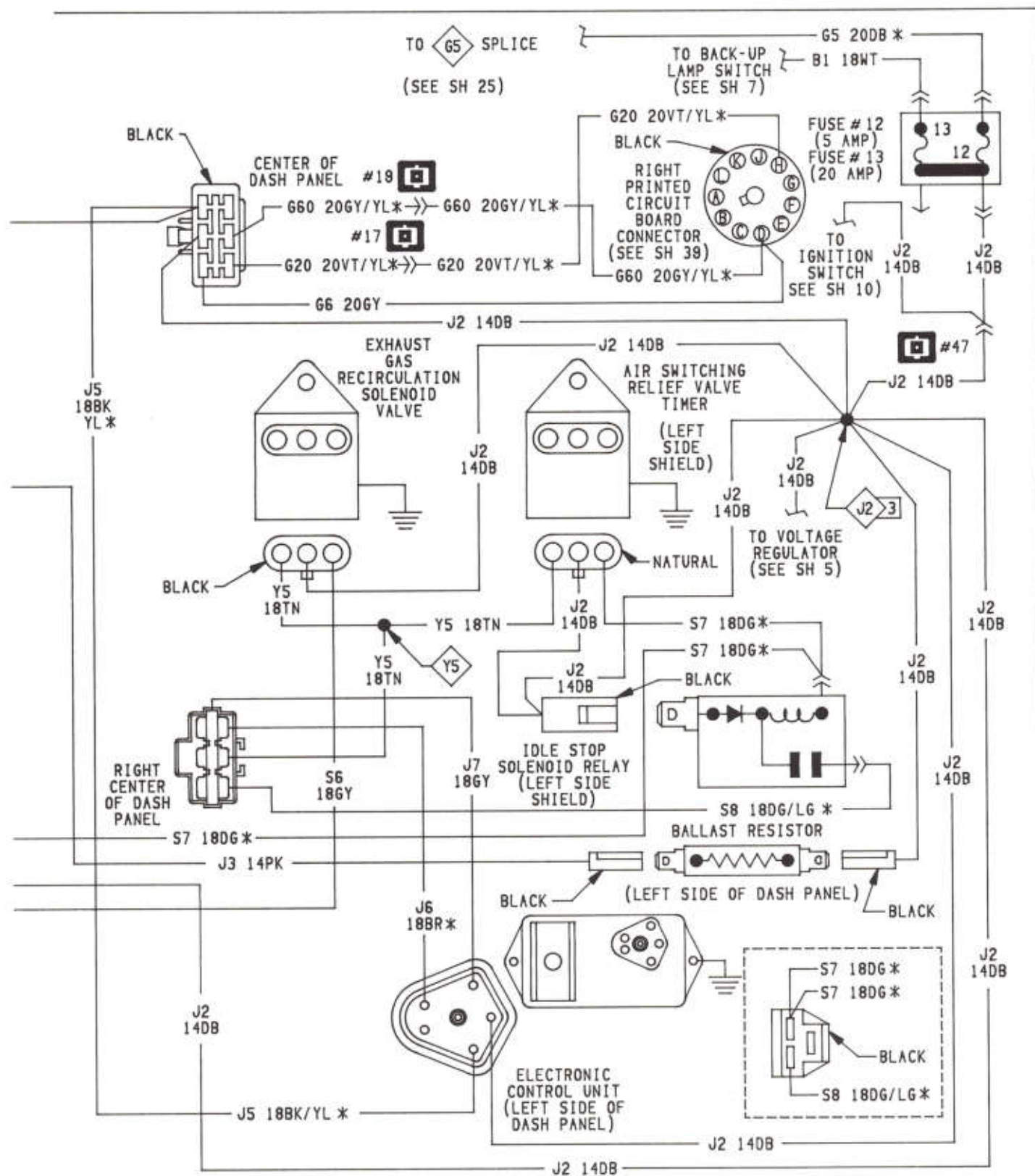
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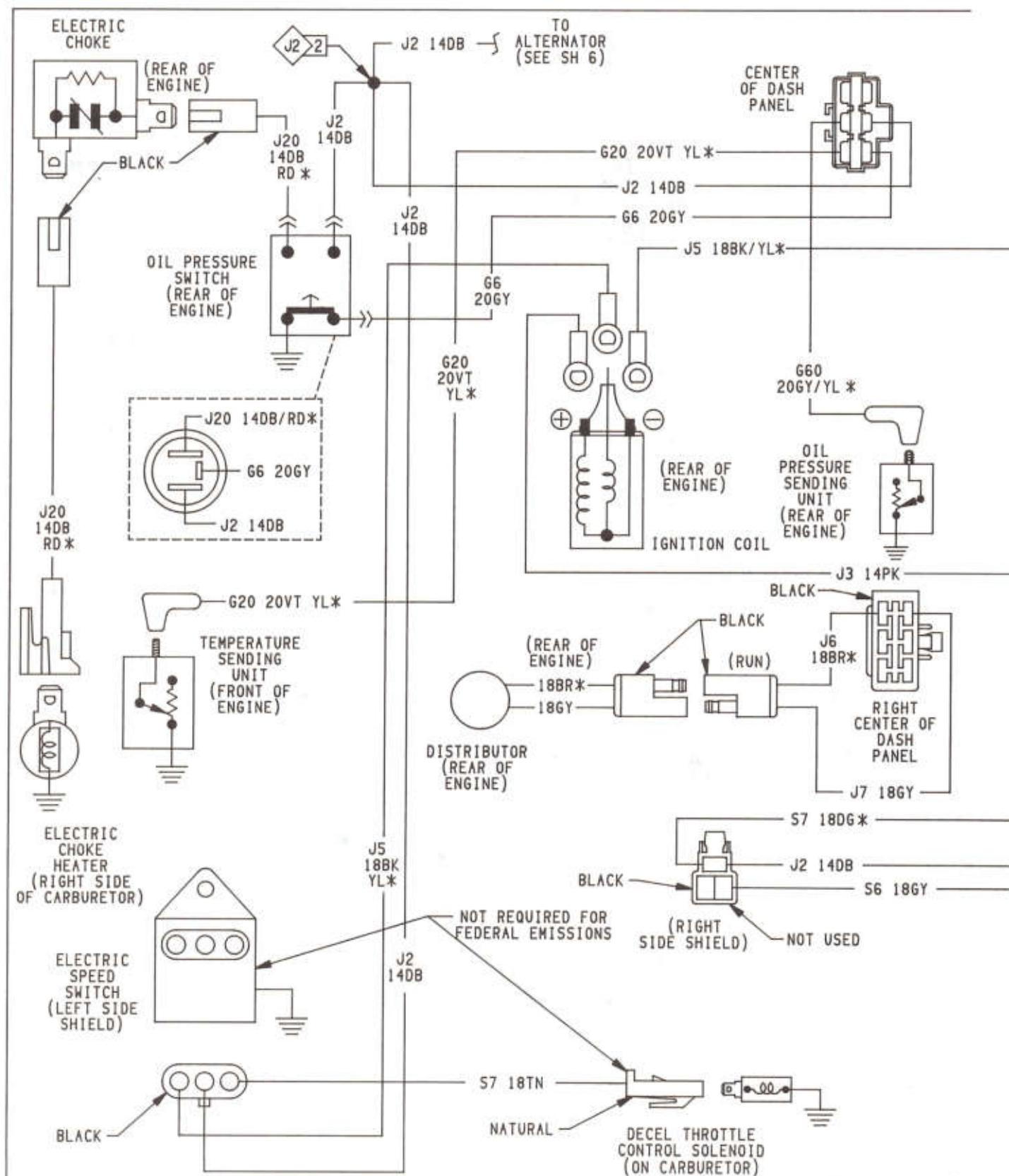
IGNITION SYSTEM-ELECTRONIC CONTROL UNIT-8 CYLINDER
360-4V (LIGHT DUTY - FEDERAL, CANADA, CALIFORNIA, &
HIGH ALTITUDE)MANUAL TRANSMISSION



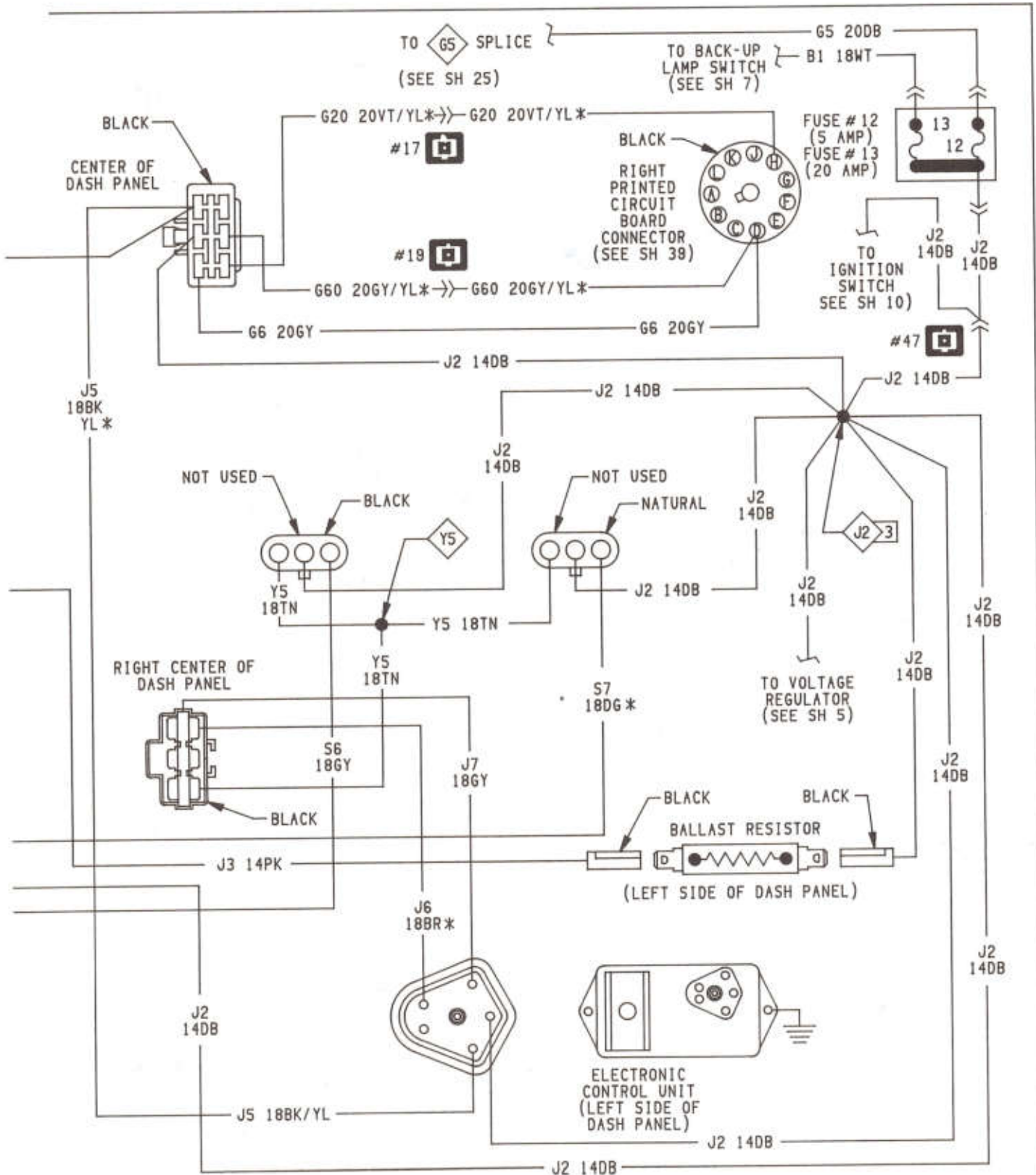




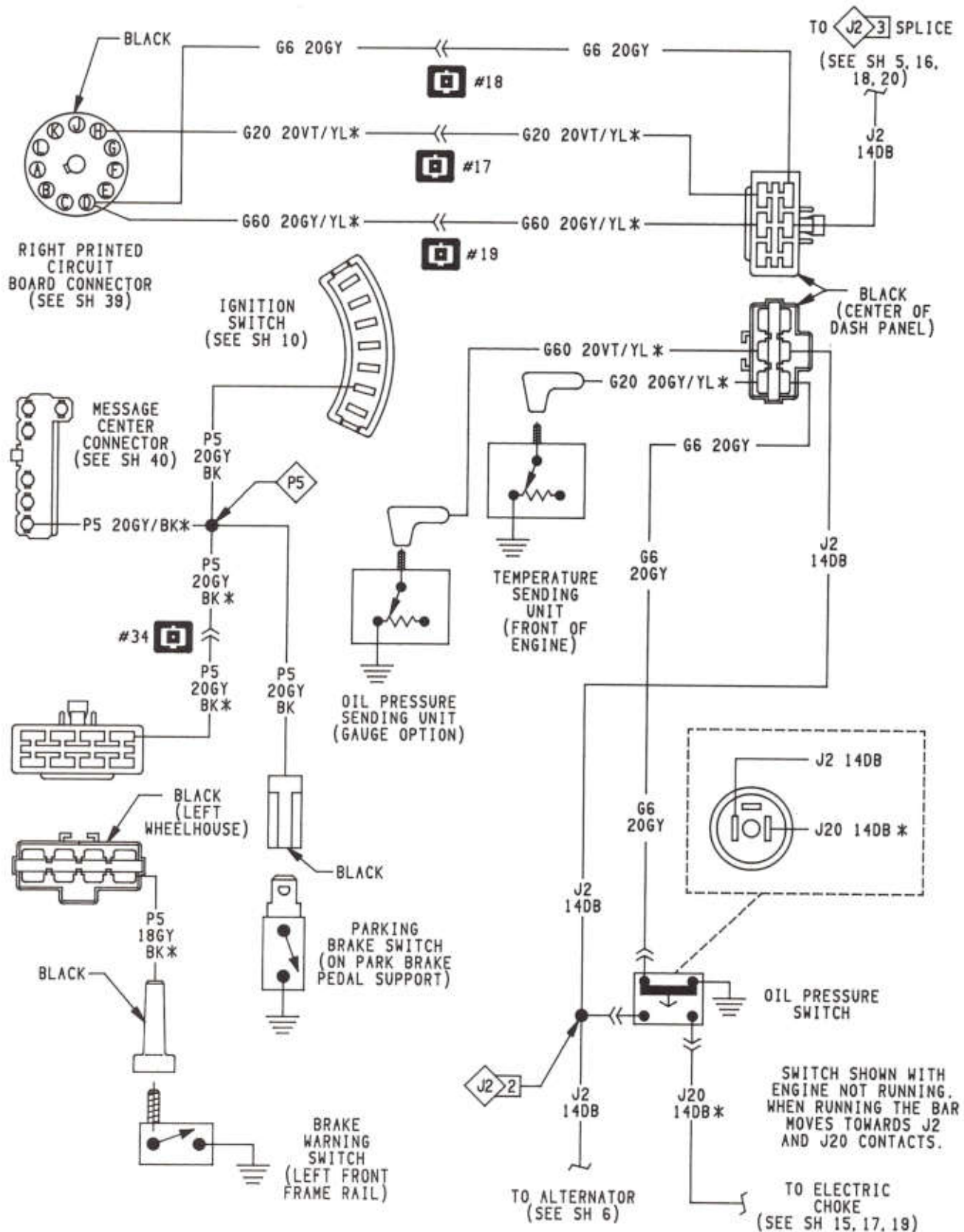
IGNITION SYSTEM-ELECTRONIC CONTROL UNIT-8 CYLINDER
360-4V (LIGHT DUTY-FEDERAL, CANADA, CALIFORNIA &
HIGH ALTITUDE)AUTOMATIC TRANSMISSION



IGNITION SYSTEM-ELECTRONIC CONTROL UNIT-8 CYLINDER
360-4V (HEAVY DUTY EMISSIONS)

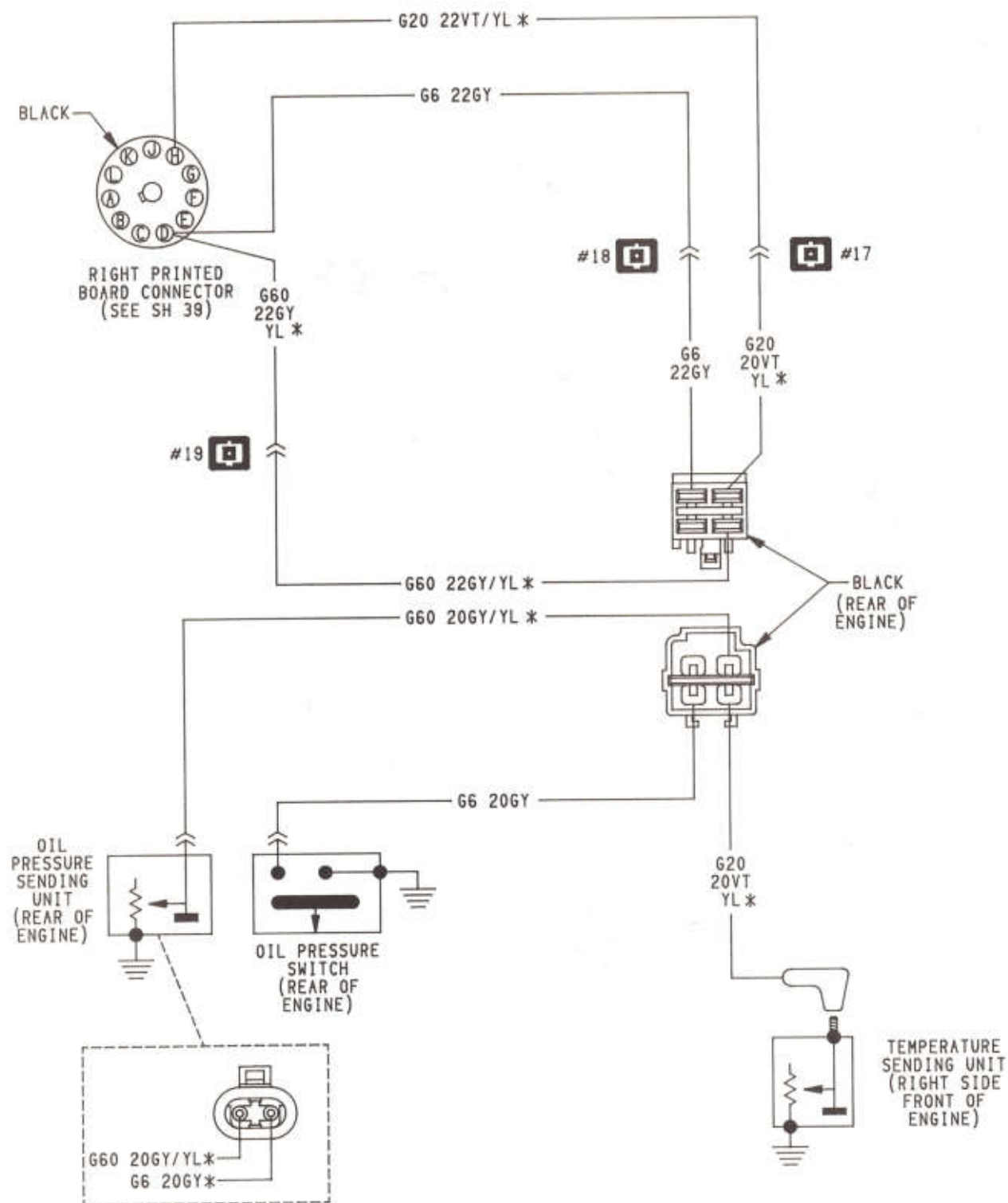


IGNITION SYSTEM-ELECTRONIC CONTROL UNIT-8 CYLINDER
360-4V (LIGHT DUTY-FEDERAL & HIGH ALTITUDE)
MANUAL TRANSMISSION

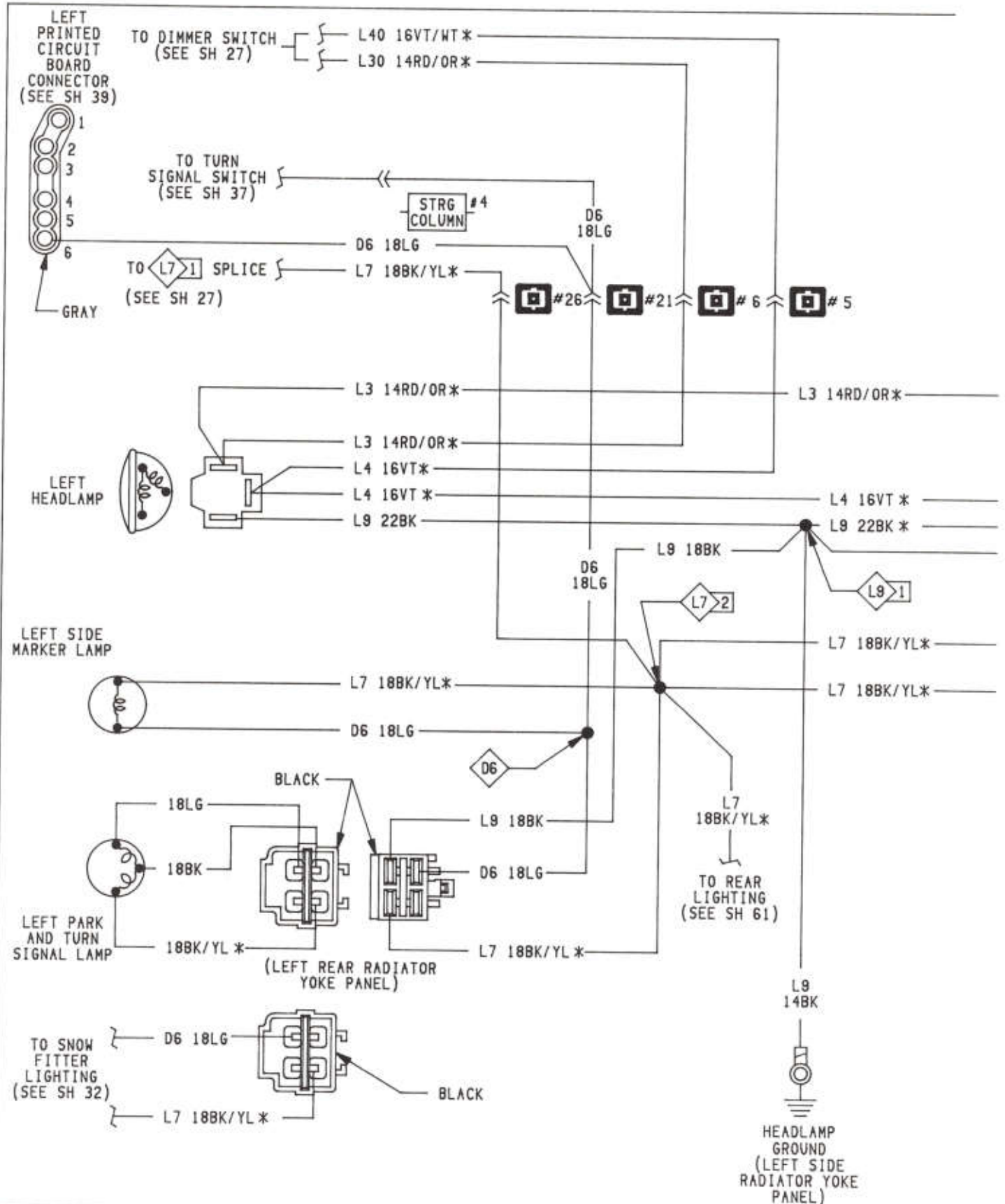


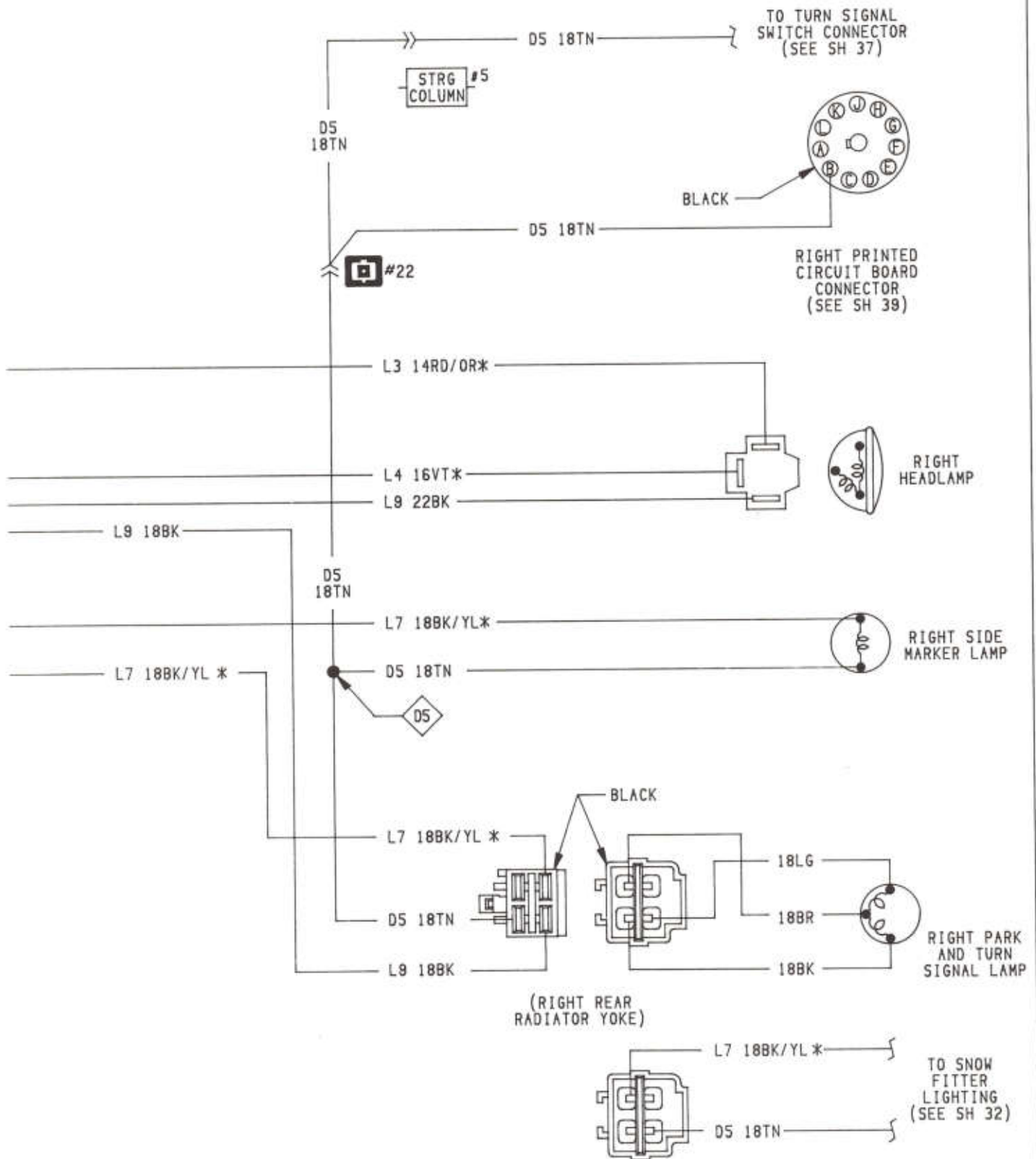
OIL, TEMPERATURE AND BRAKE SWITCH
WITH ELECTRONIC CONTROL UNIT IGNITION

RR8WH13

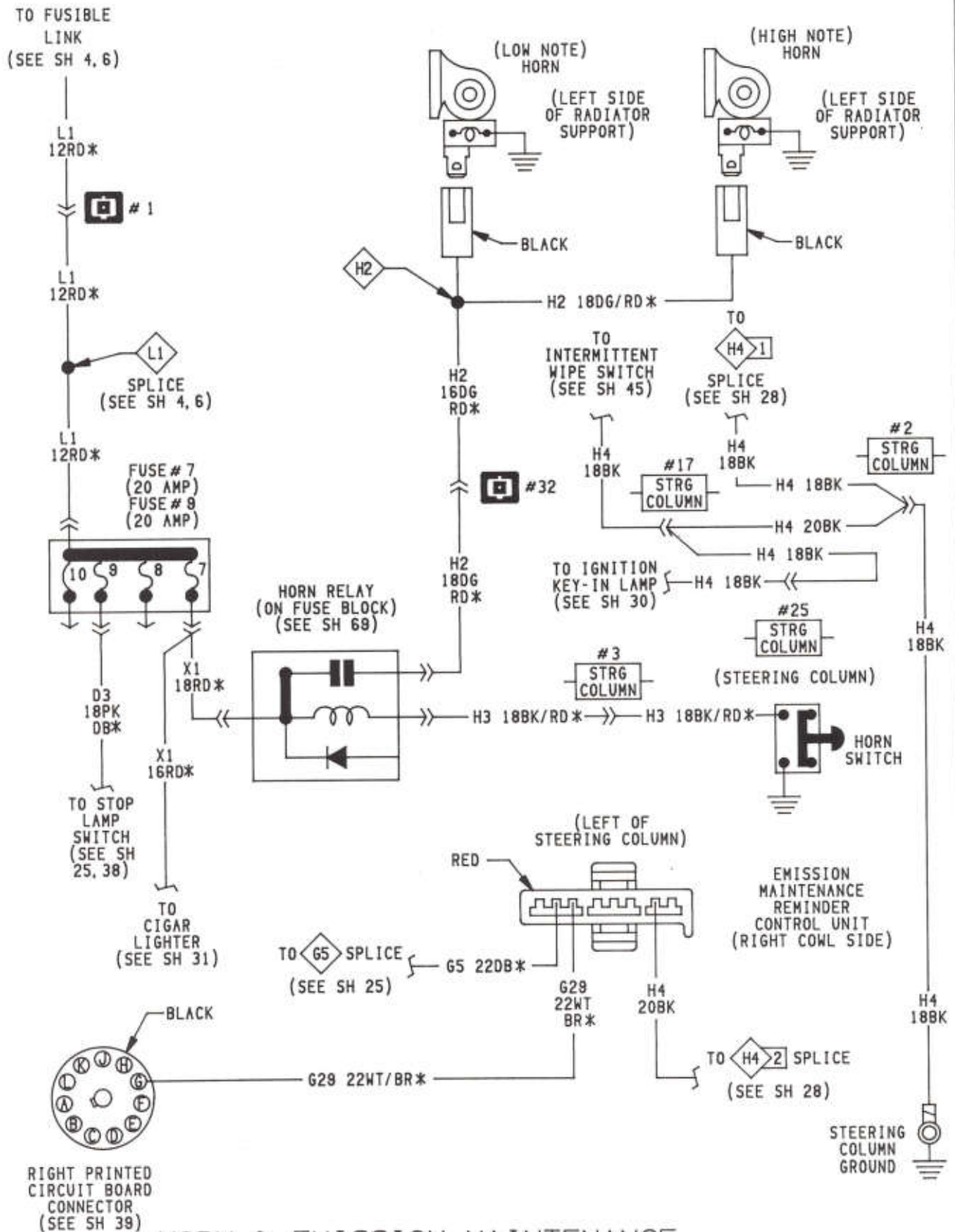


OIL PRESSURE AND TEMPERATURE SYSTEM
WITH 3.9 & 5.2L ELECTRONIC
FUEL INJECTION IGNITION

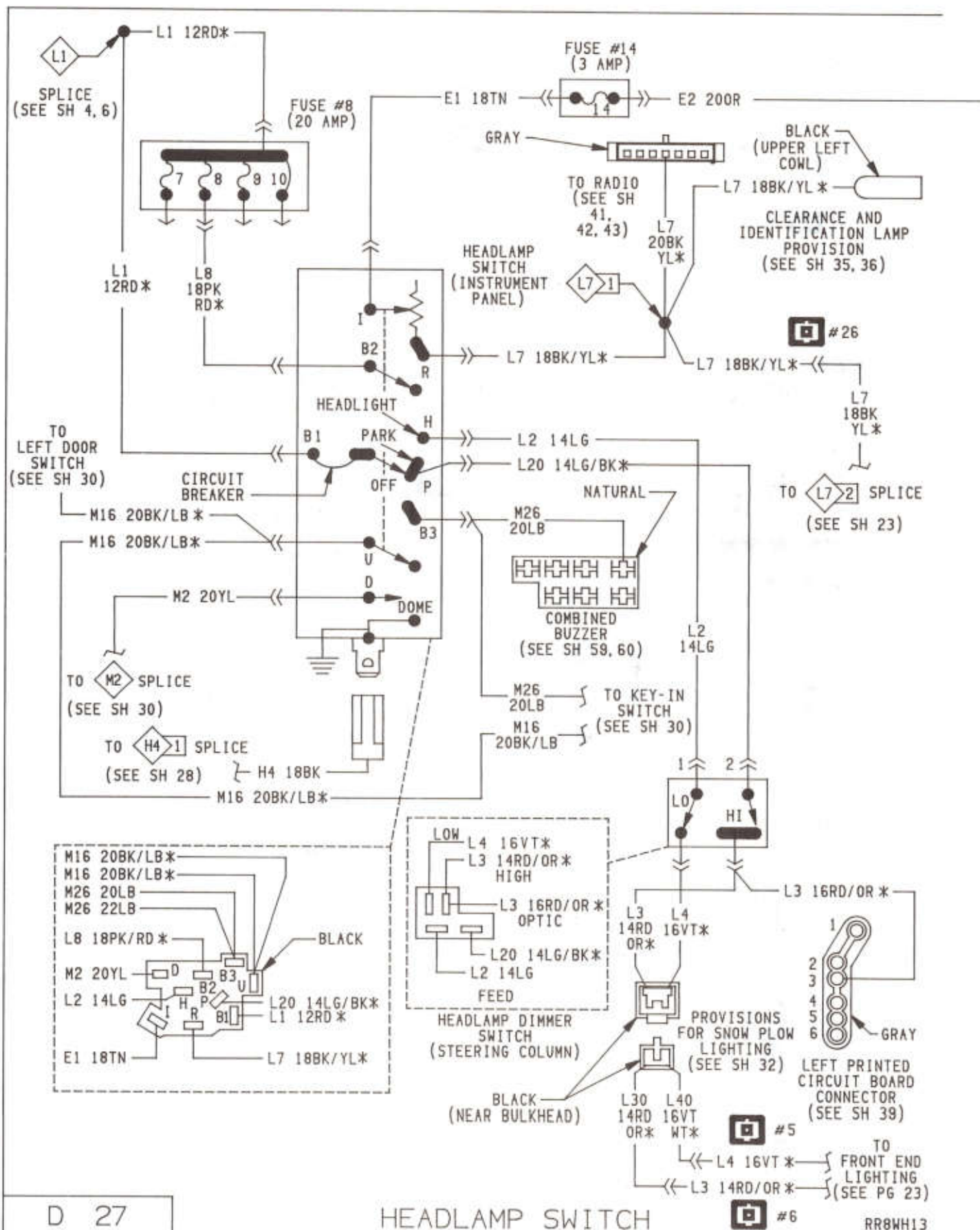


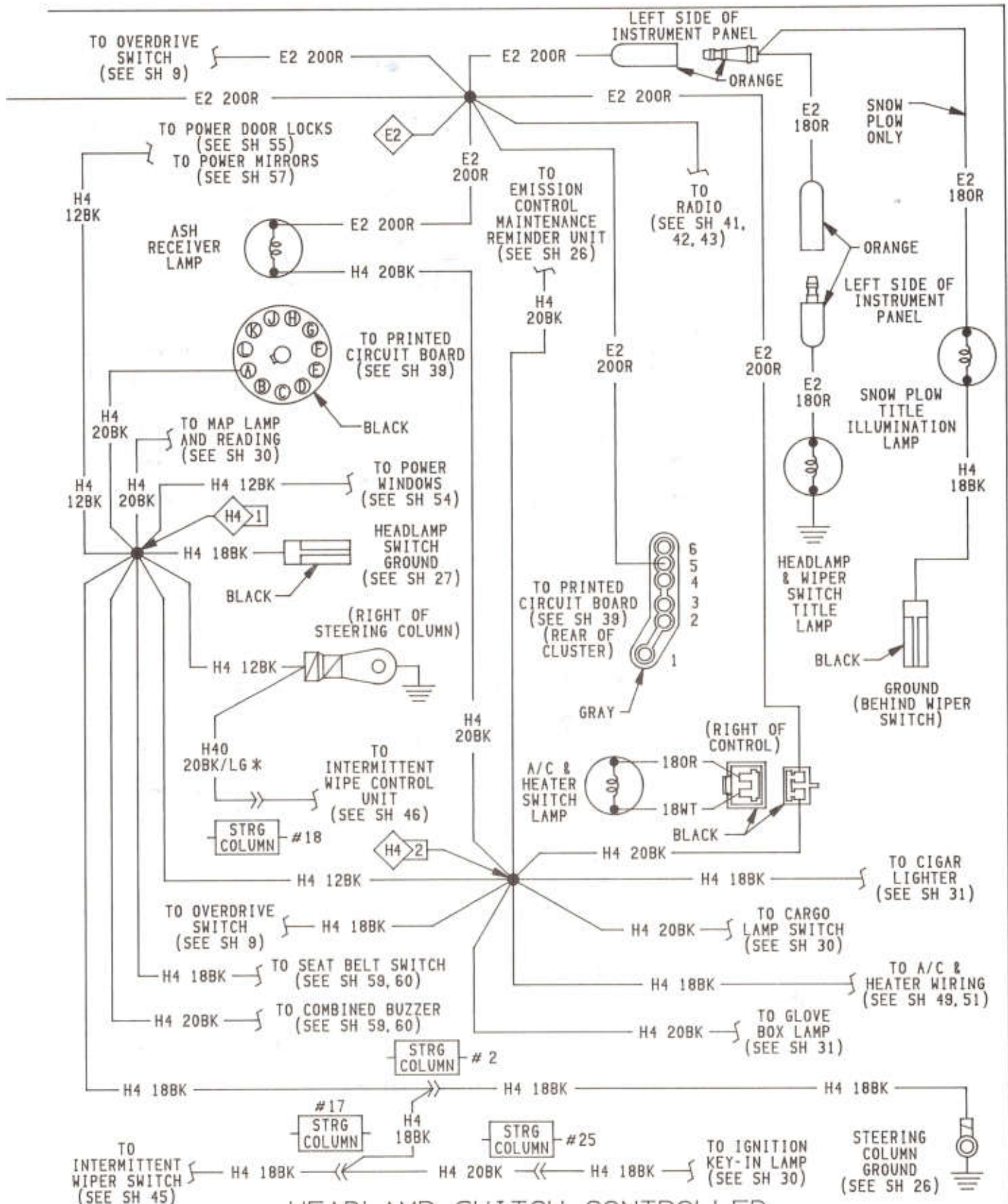


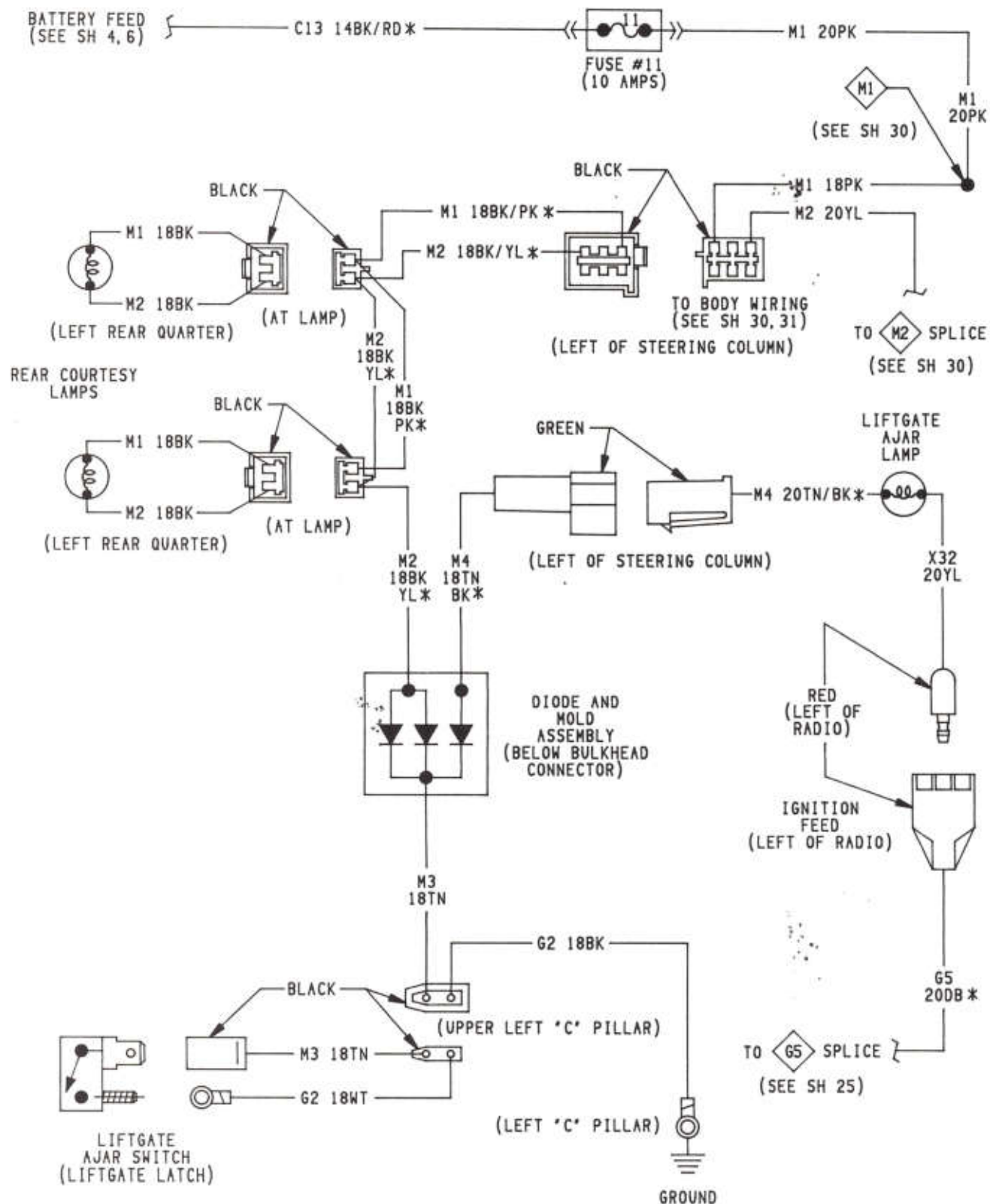


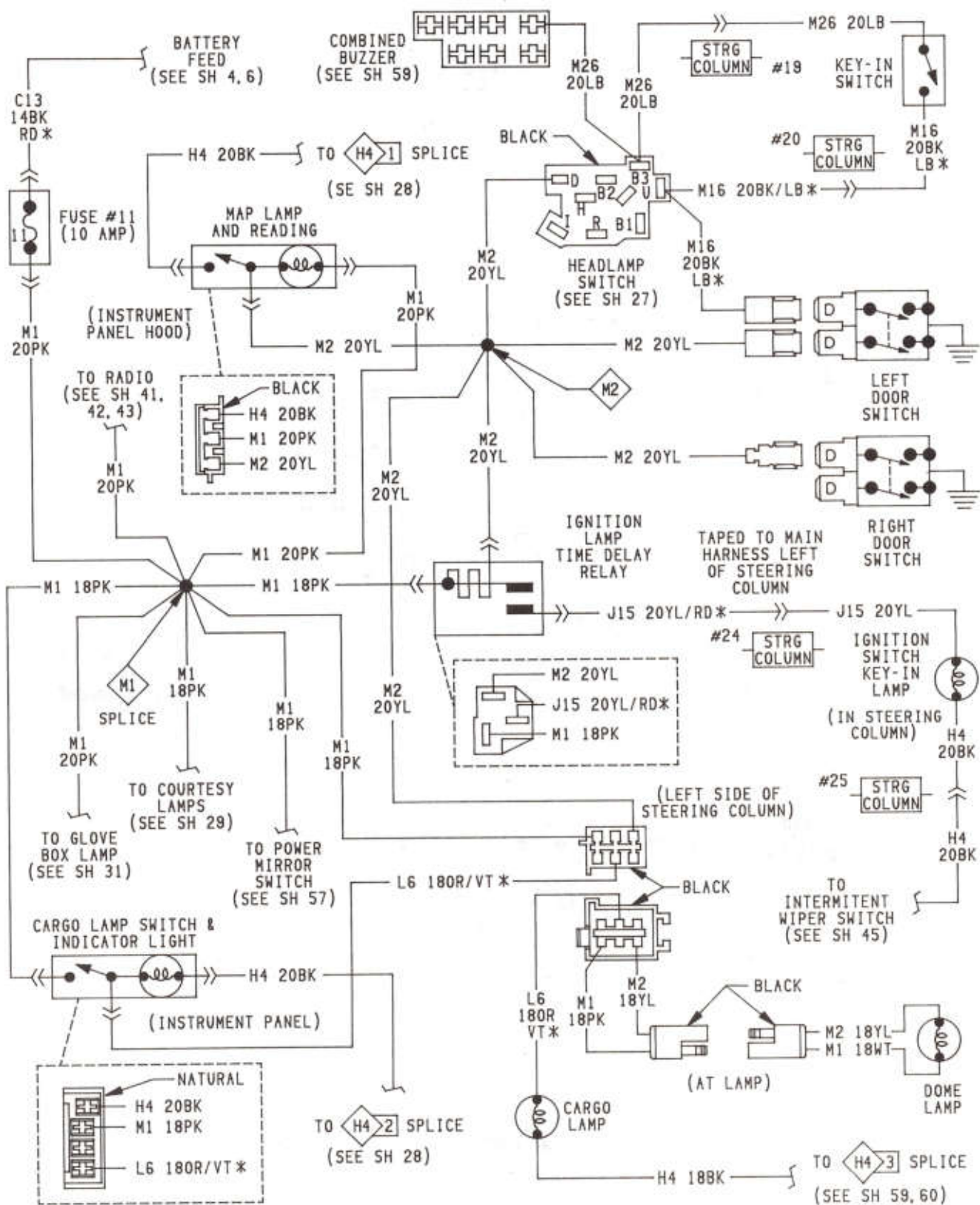


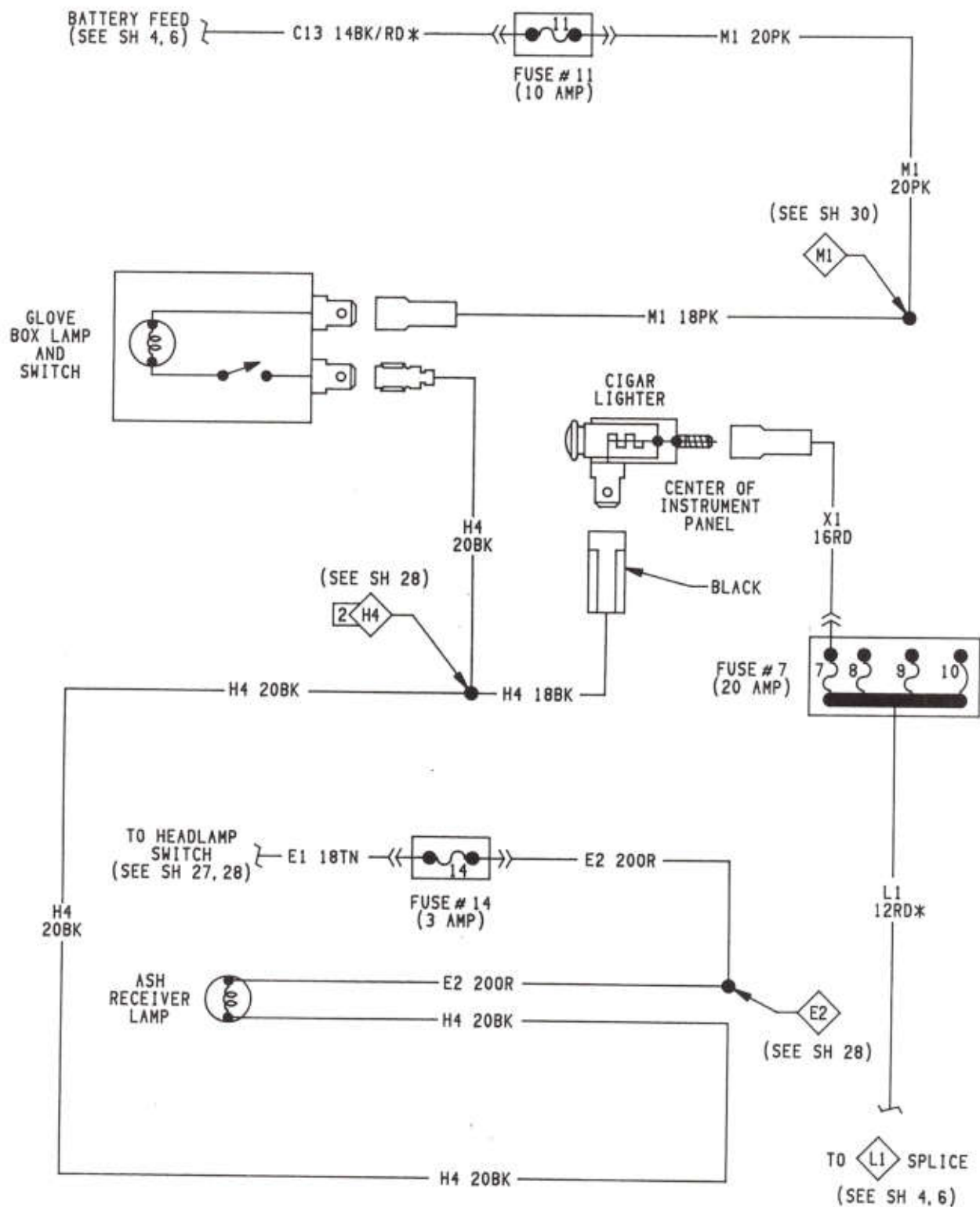
HORN & EMISSION MAINTENANCE REMINDER



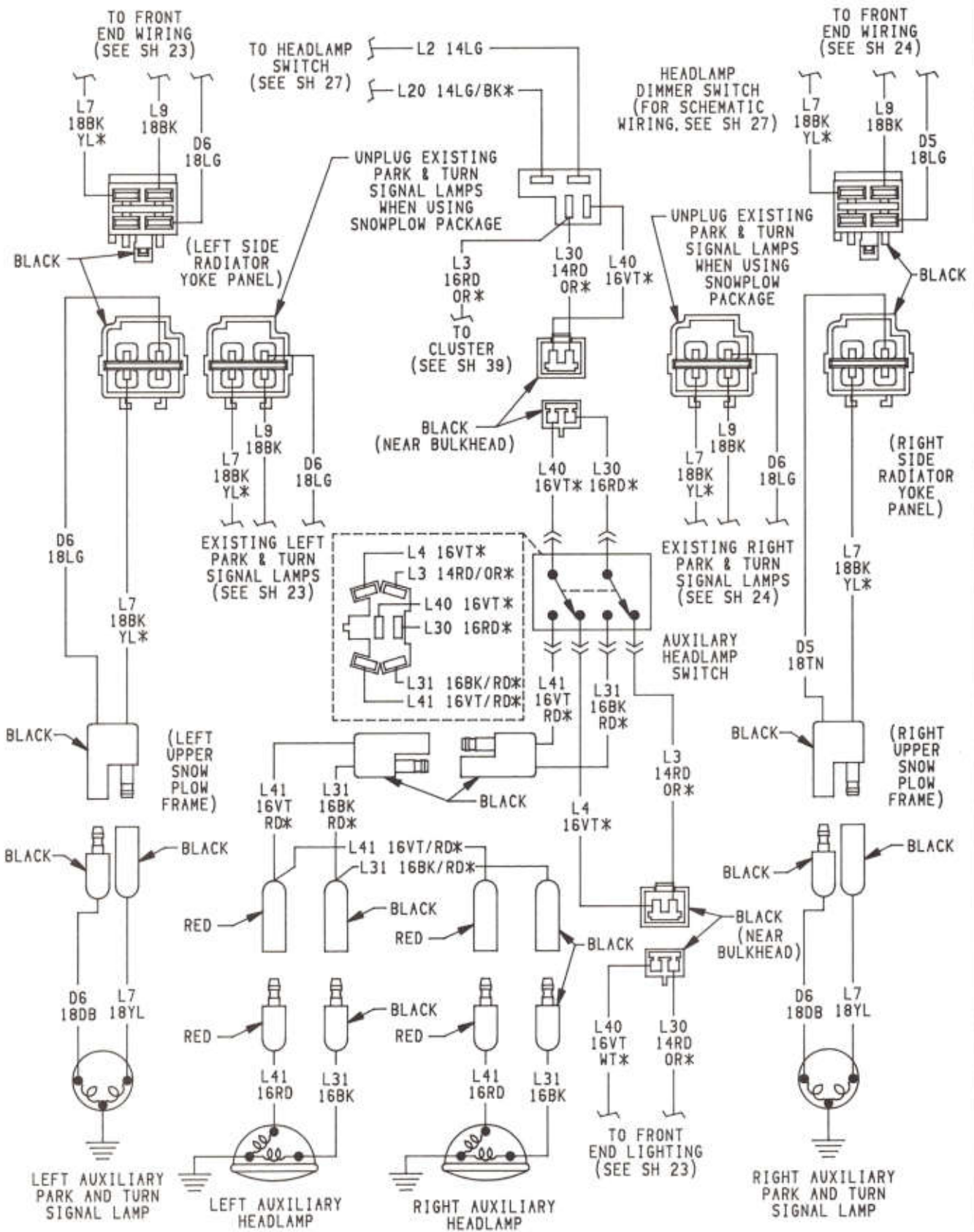


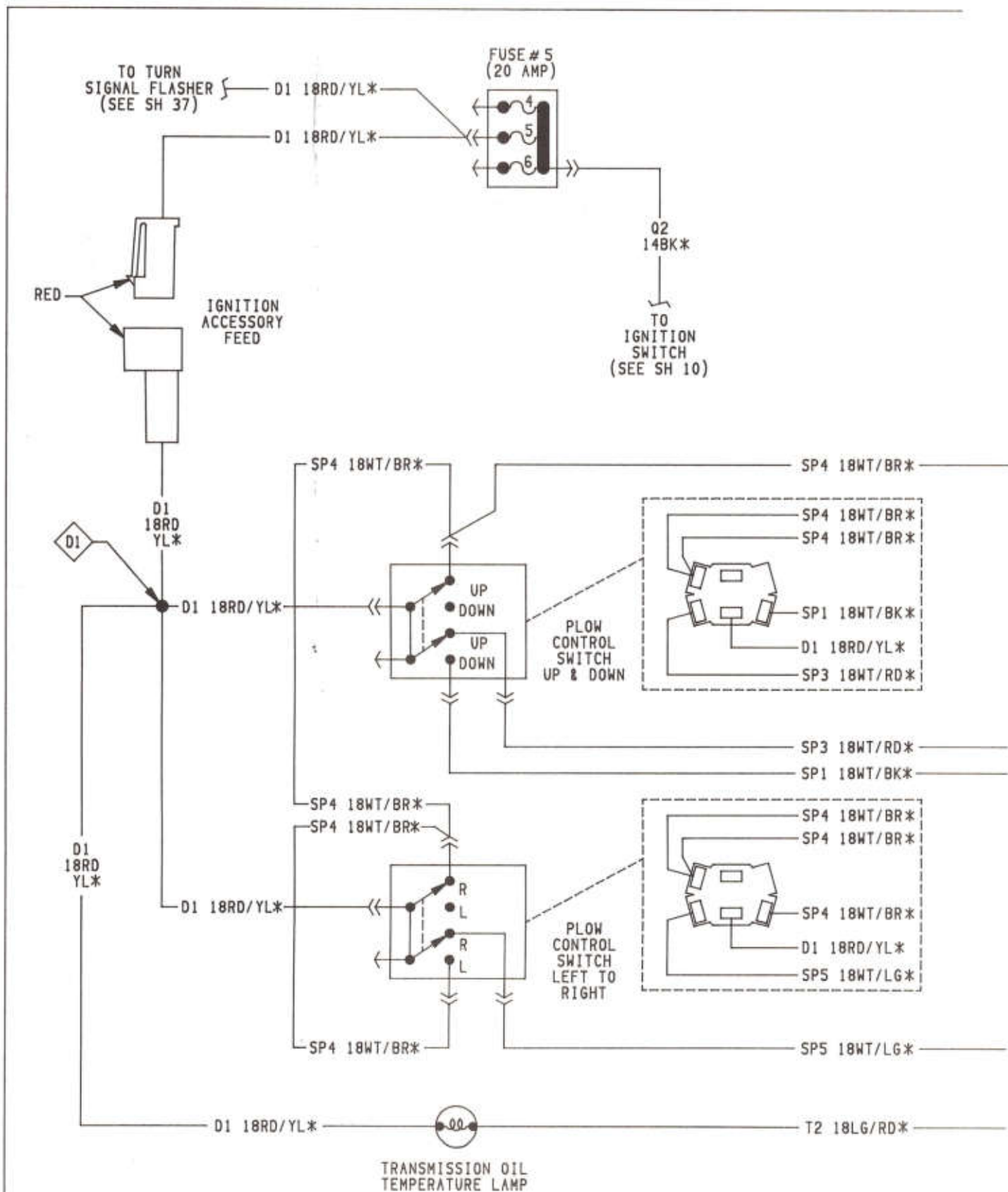


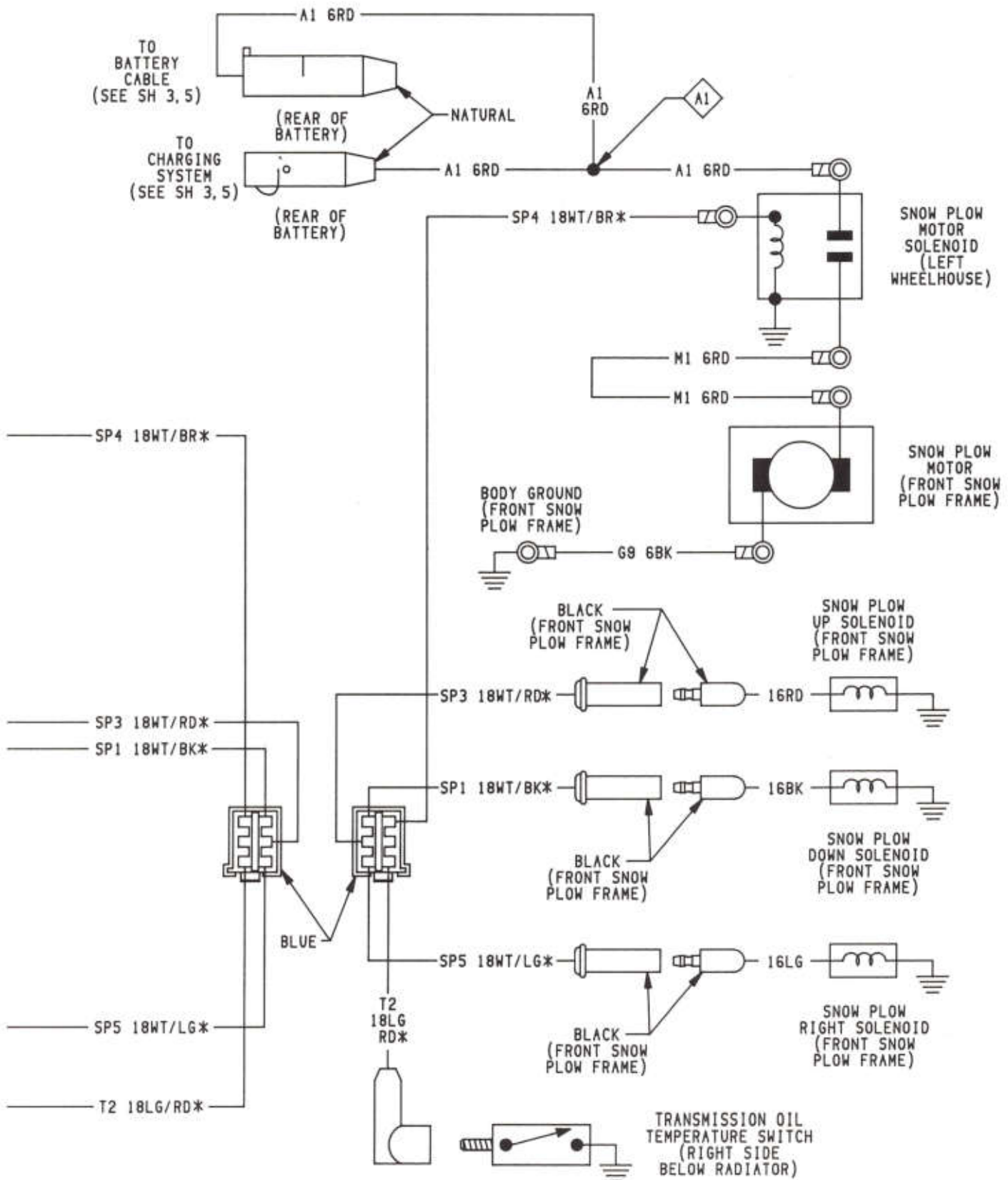


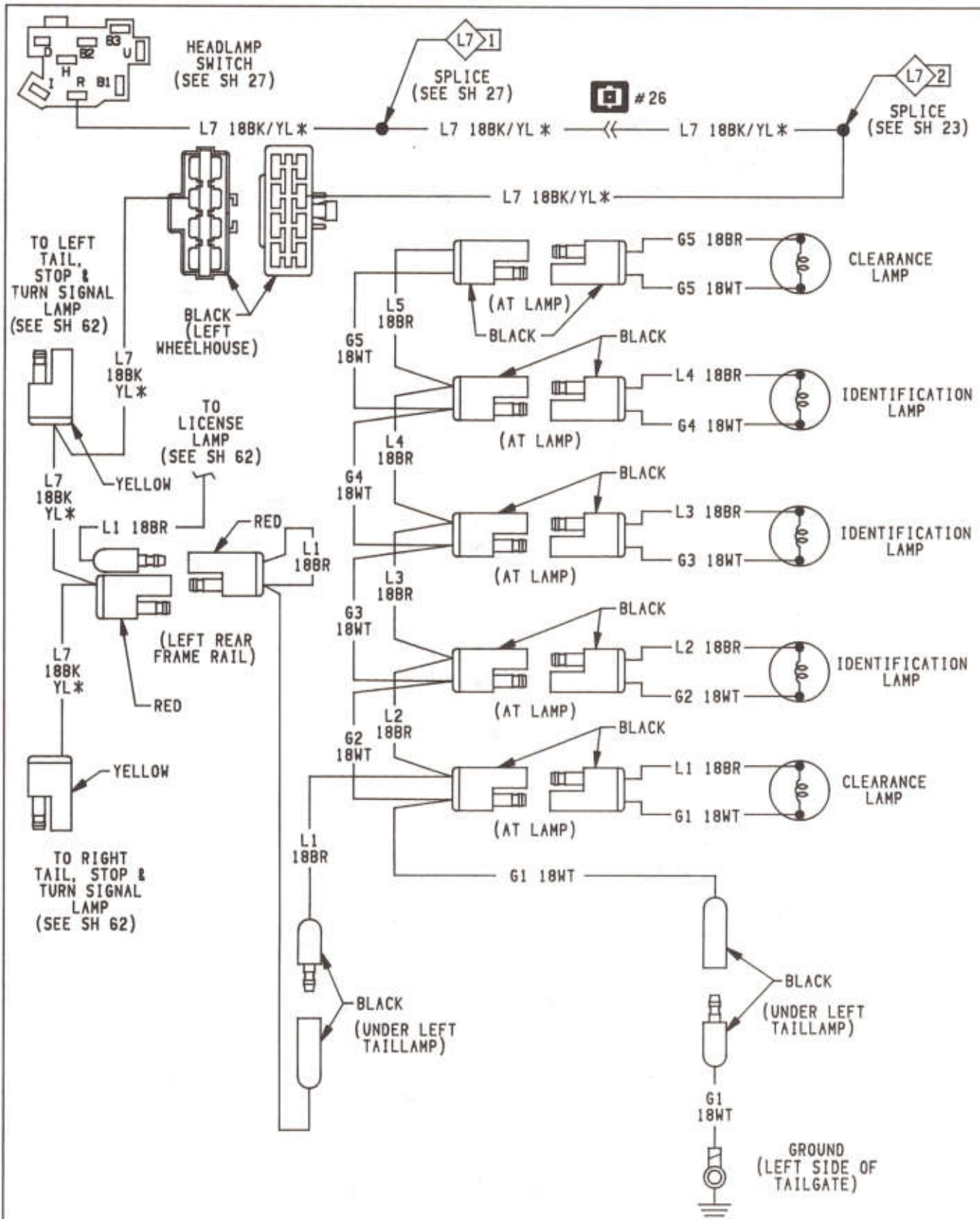


CIGAR LIGHTER, ASH RECEIVER LAMP
& GLOVE BOX LAMP

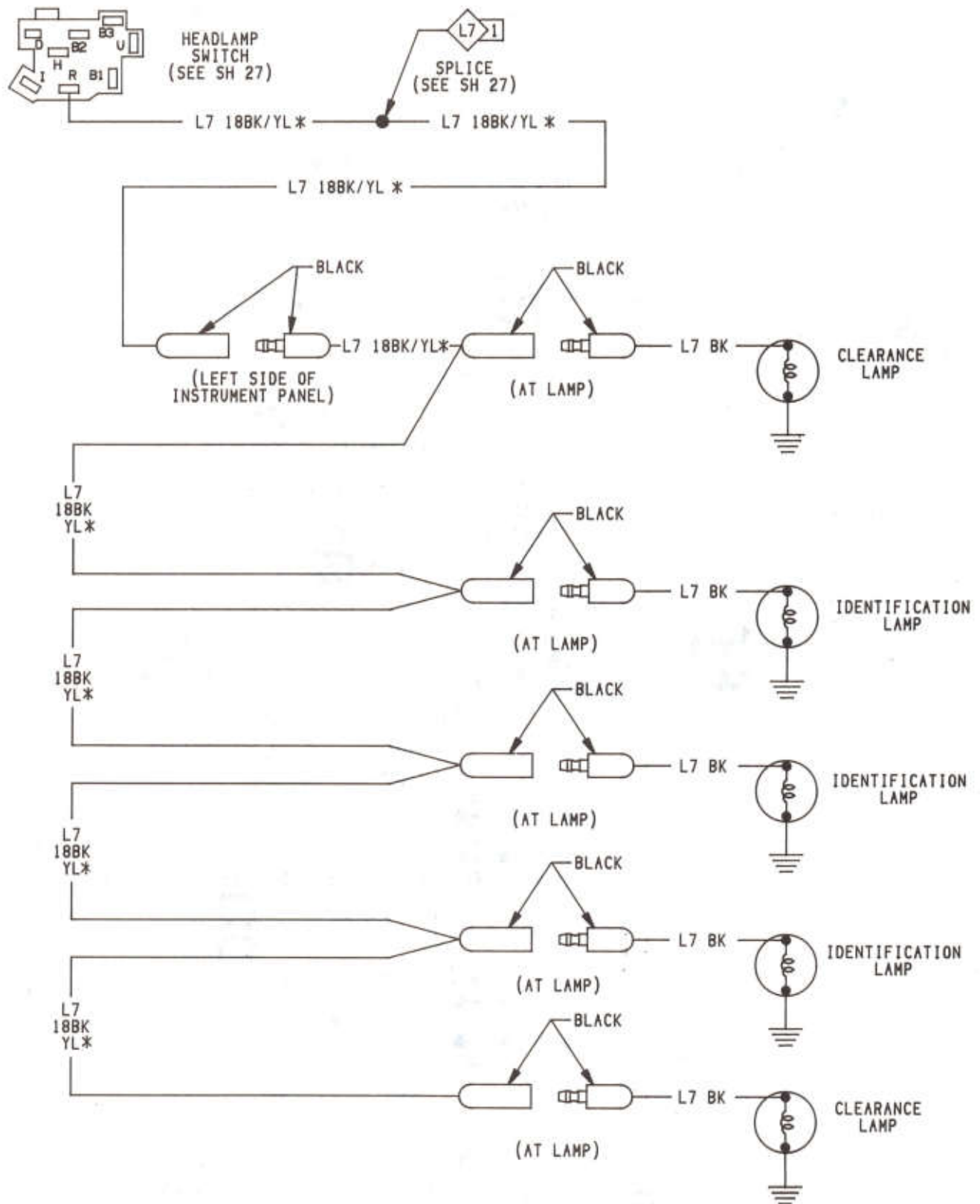






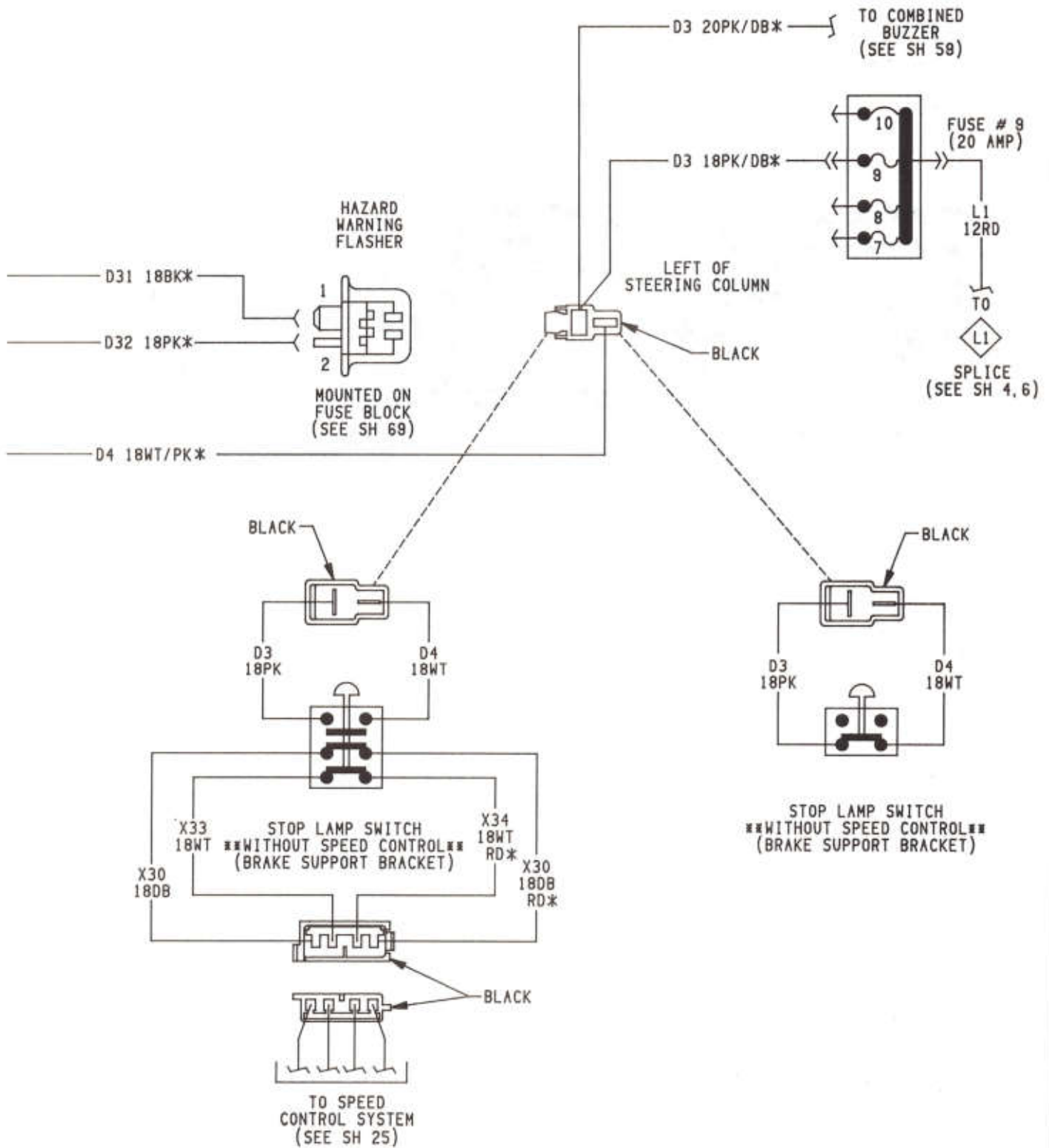


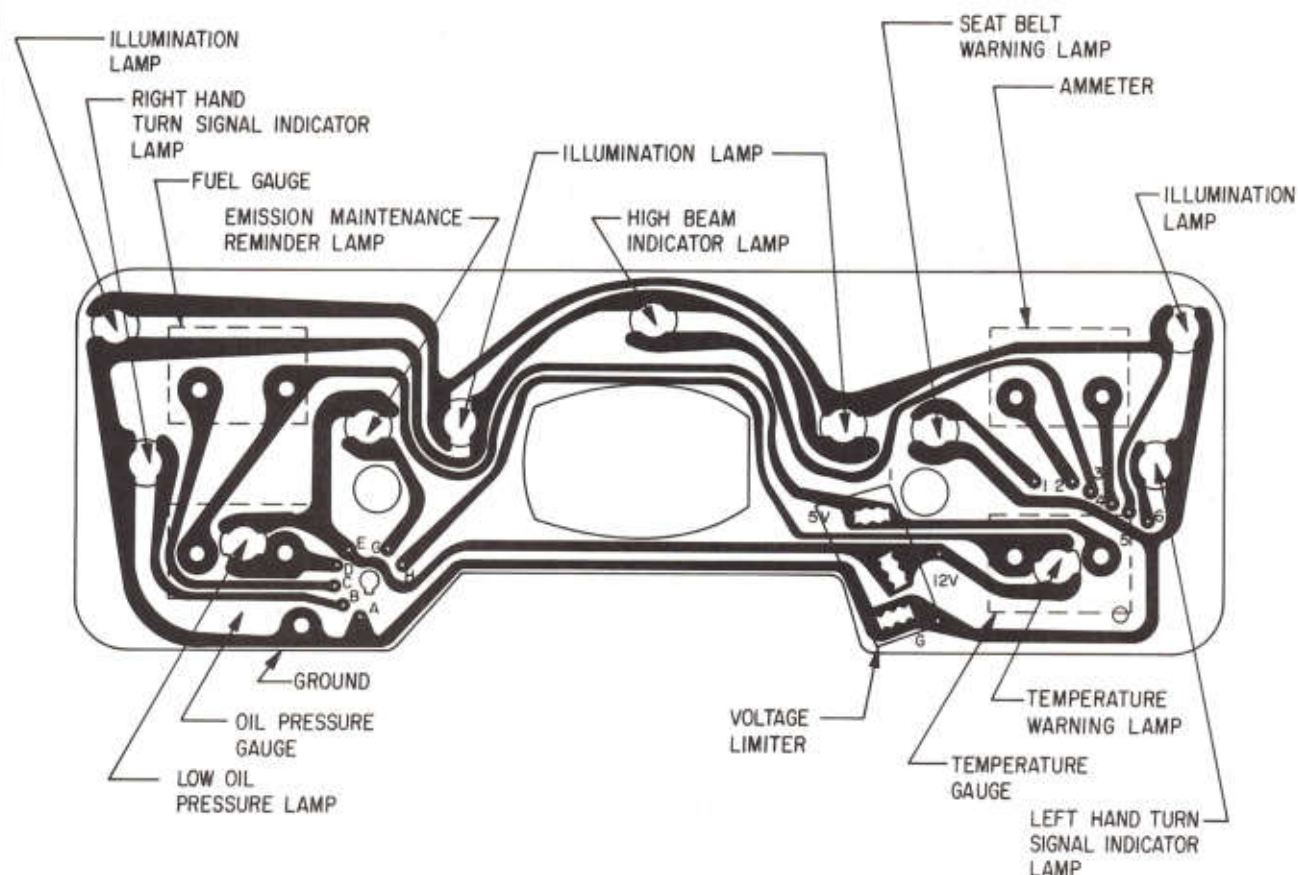
CLEARANCE AND IDENTIFICATION LAMPS
(DUAL REAR WHEELS)



FRONT CLEARANCE AND IDENTIFICATION LAMPS (ROOF)



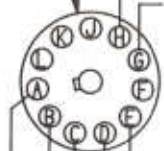




BLACK

G20 20VT/YL*
TEMPERATURE SENDING UNIT
(SEE SH 15 THRU 22)

G29 22WT/BR* EMISSION
MAINTENANCE REMINDER LAMP
(SEE SH 26)



G5 20DB*
IGNITION 12 VOLTS
(SEE SH 25, 59, 60)

G6 20GY OIL PRESSURE
SENDER WITH LAMP

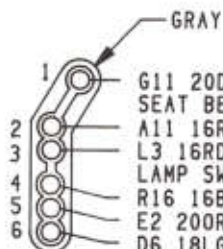
G60 20GY/YL* OIL PRESSURE
SENDER WITH GAUGE
(SEE SH 15 THRU 22)

G4 20DB/YL*
FUEL SENDER (SEE SH 59, 60)

D5 18TN
RIGHT HAND TURN SIGNAL (SEE SH 24, 37)

H4 20BK
GROUND (SEE SH 28)

TERMINAL SIDE OF CONNECTOR SHOWN
RIGHT PRINTED
CIRCUIT BOARD CONNECTOR



GRAY

G11 20DB/RD
SEAT BELT WARNING LAMP SWITCH (SEE SH 59, 60)

A11 16RD AMMETER CHARGE (SEE SH 3, 5)

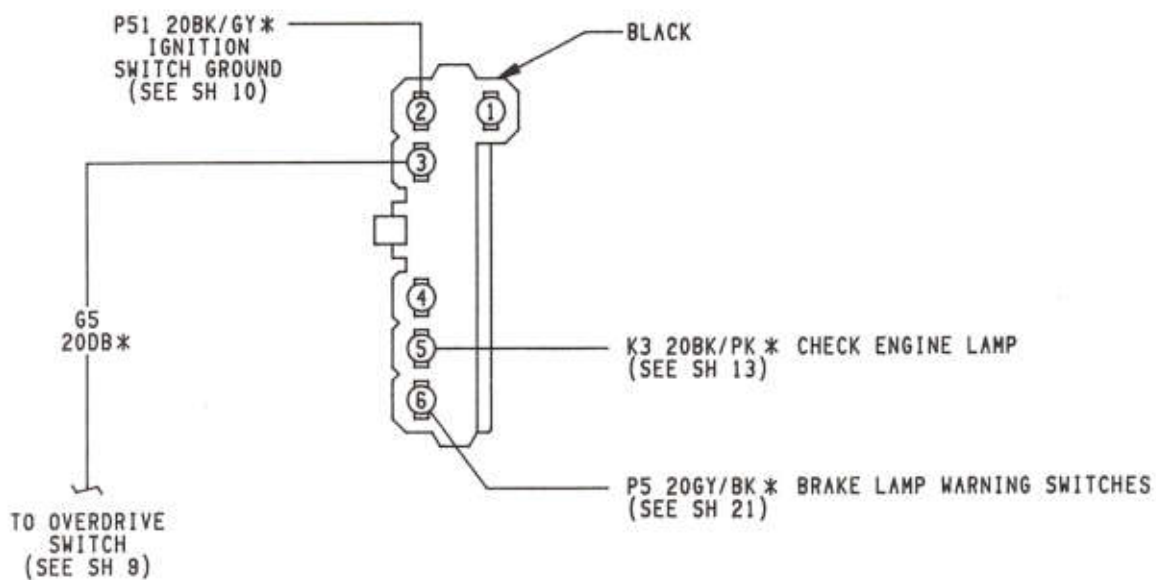
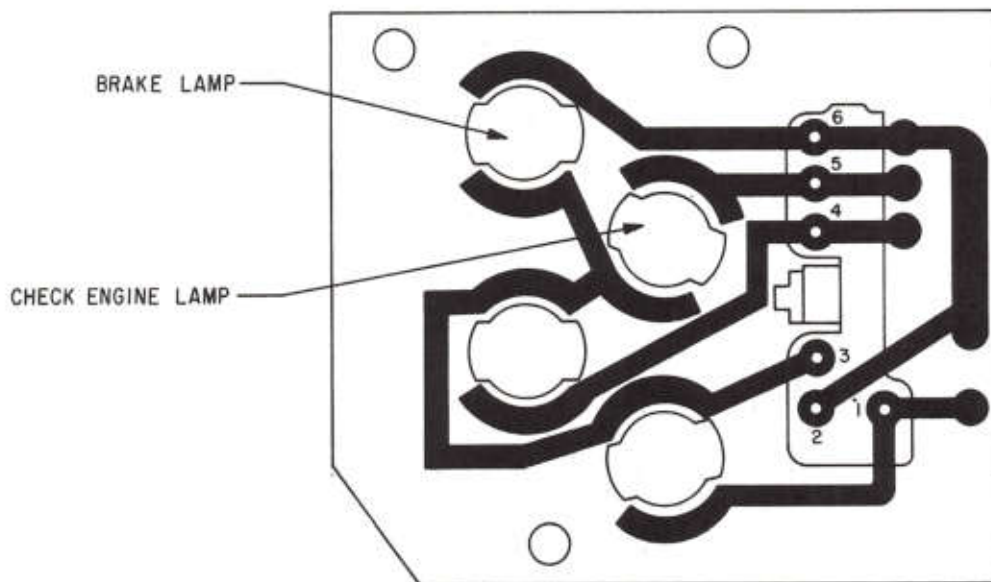
L3 16RD/OR* HIGH BEAM INDICATOR
LAMP SWITCH (SEE SH 27)

R16 16BK AMMETER DISCHARGE (SEE SH 3, 5)

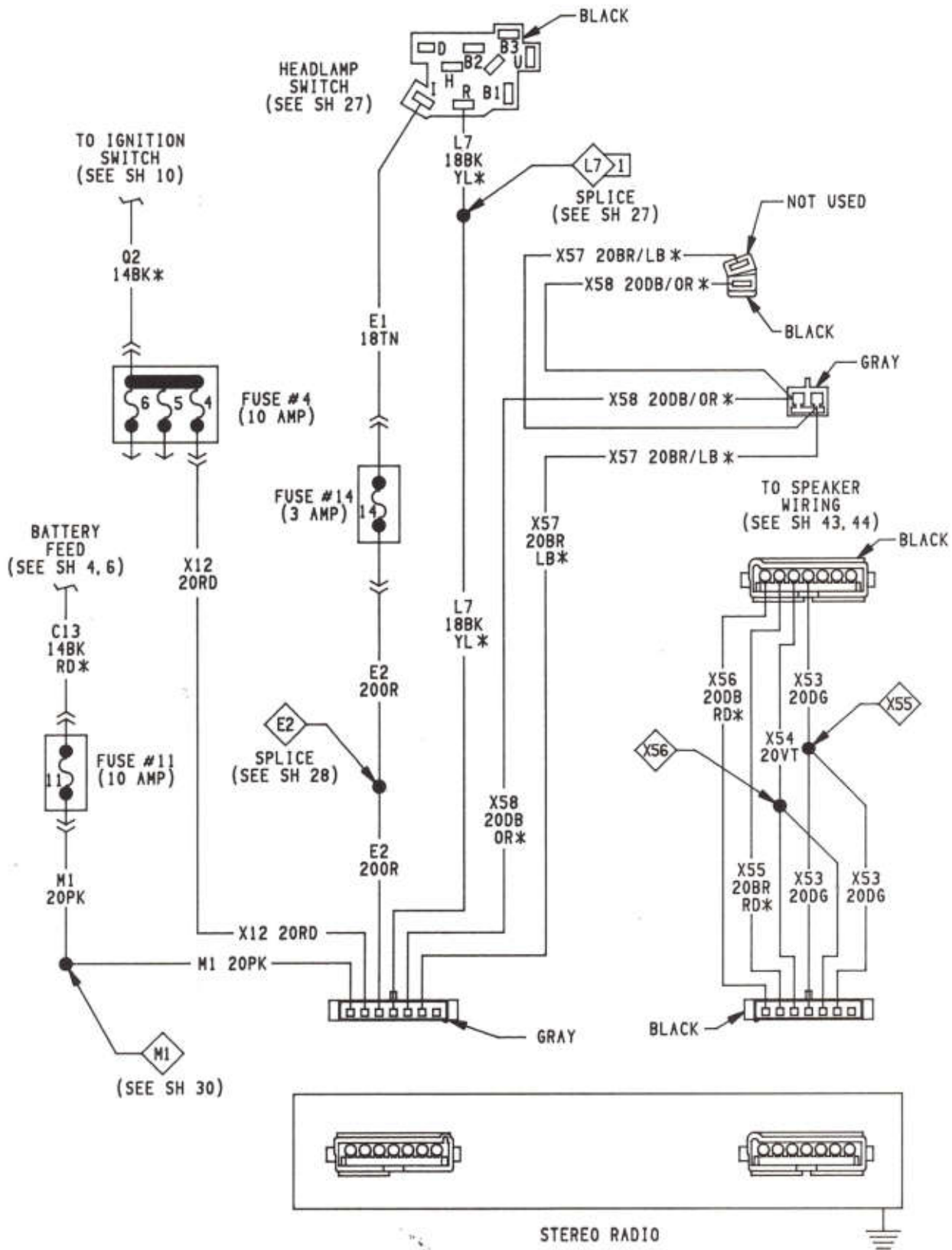
E2 20OR CLUSTER ILLUMINATION (SEE SH 28)

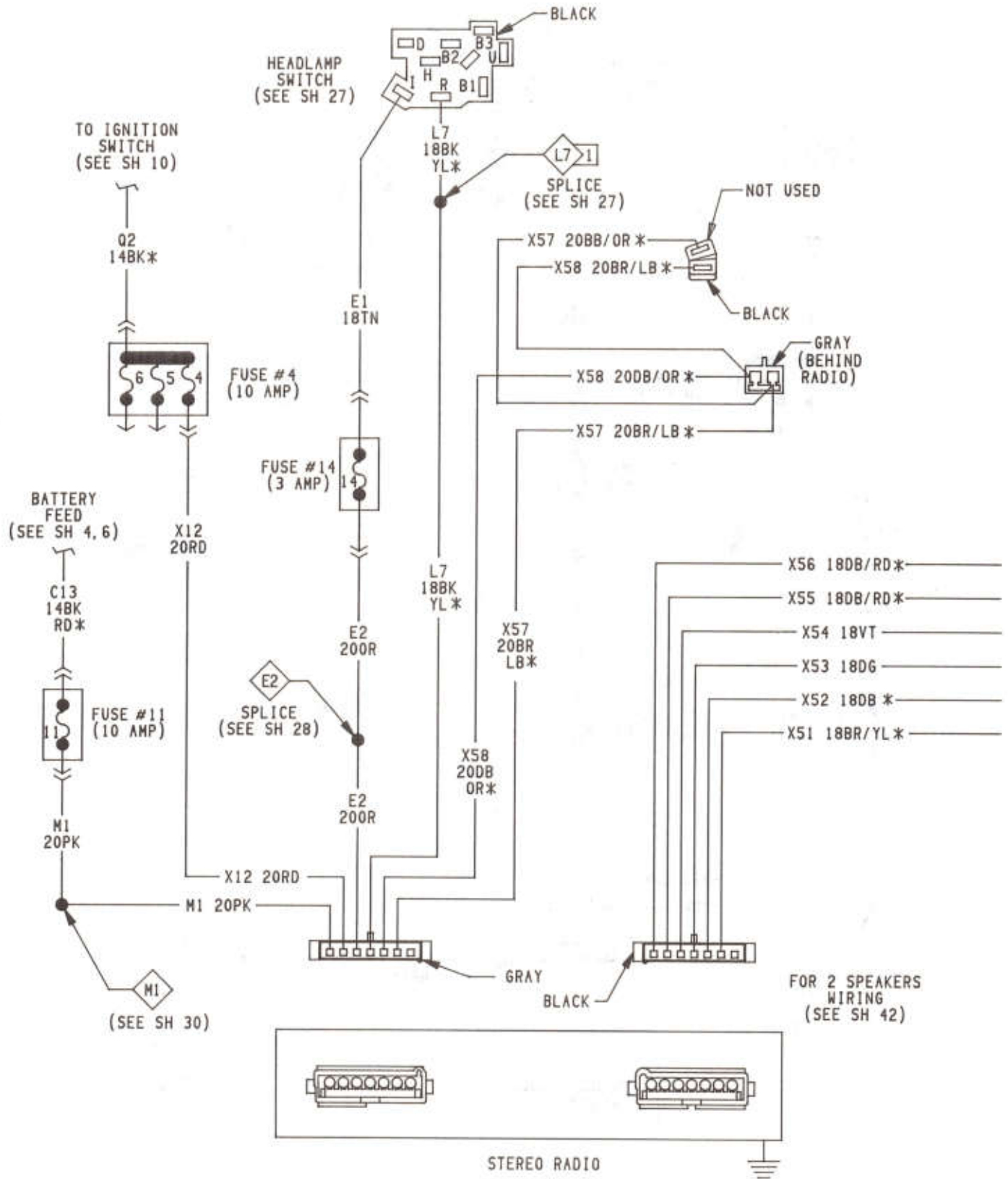
D6 18LG LEFT HAND TURN SIGNAL (SEE SH 23, 37)

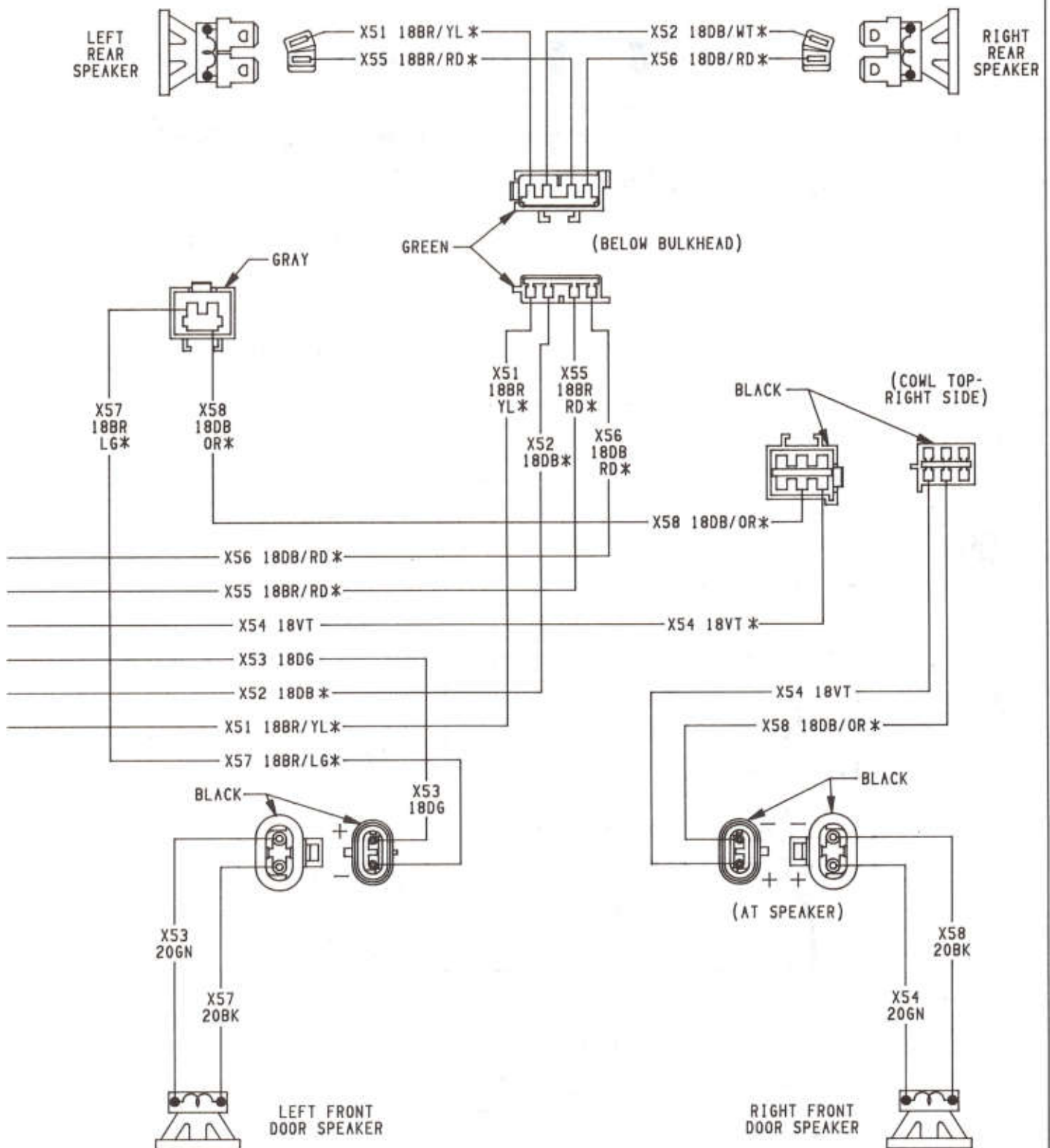
TERMINAL SIDE OF CONNECTOR SHOWN
LEFT PRINTED
CIRCUIT BOARD CONNECTOR

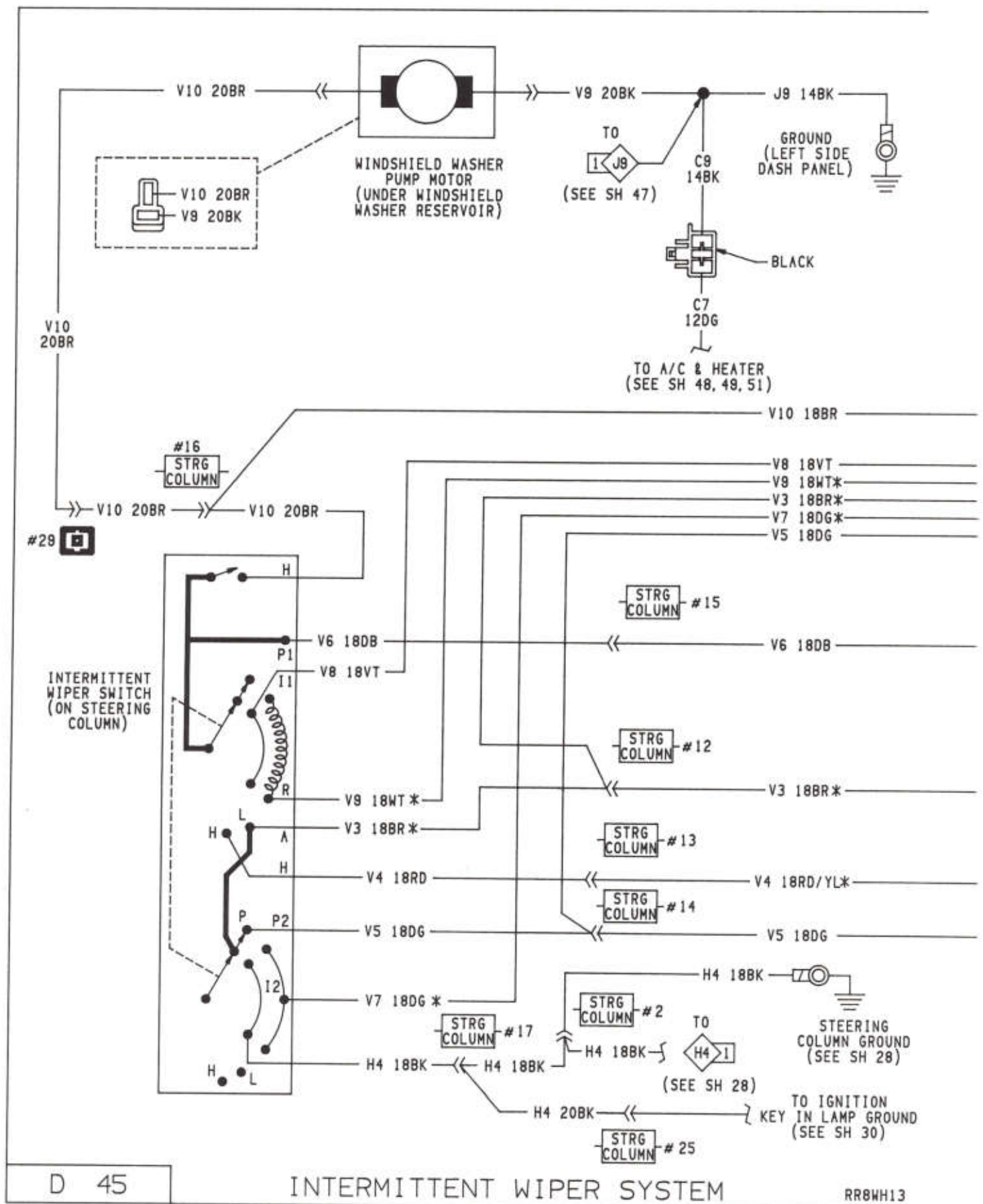


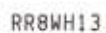




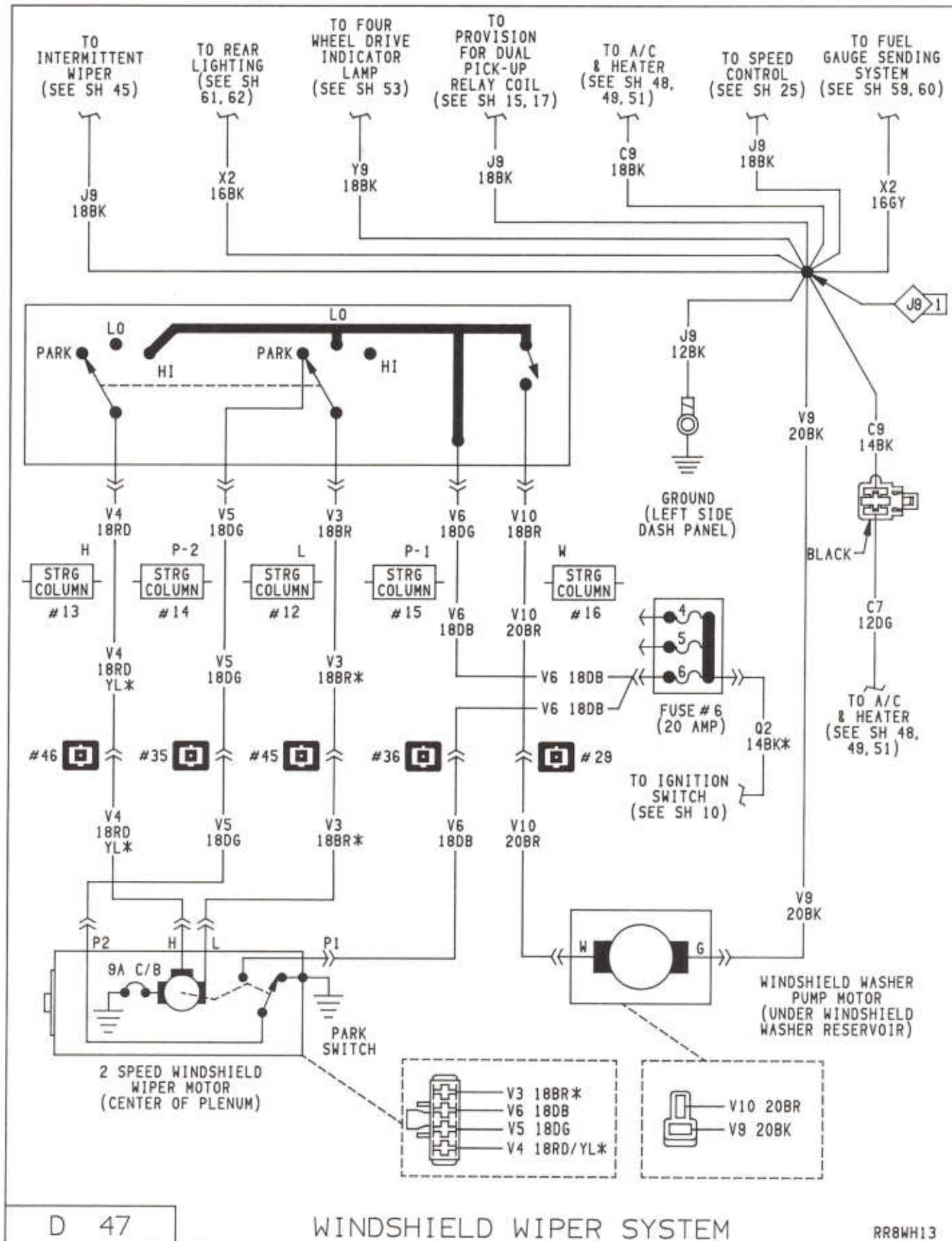


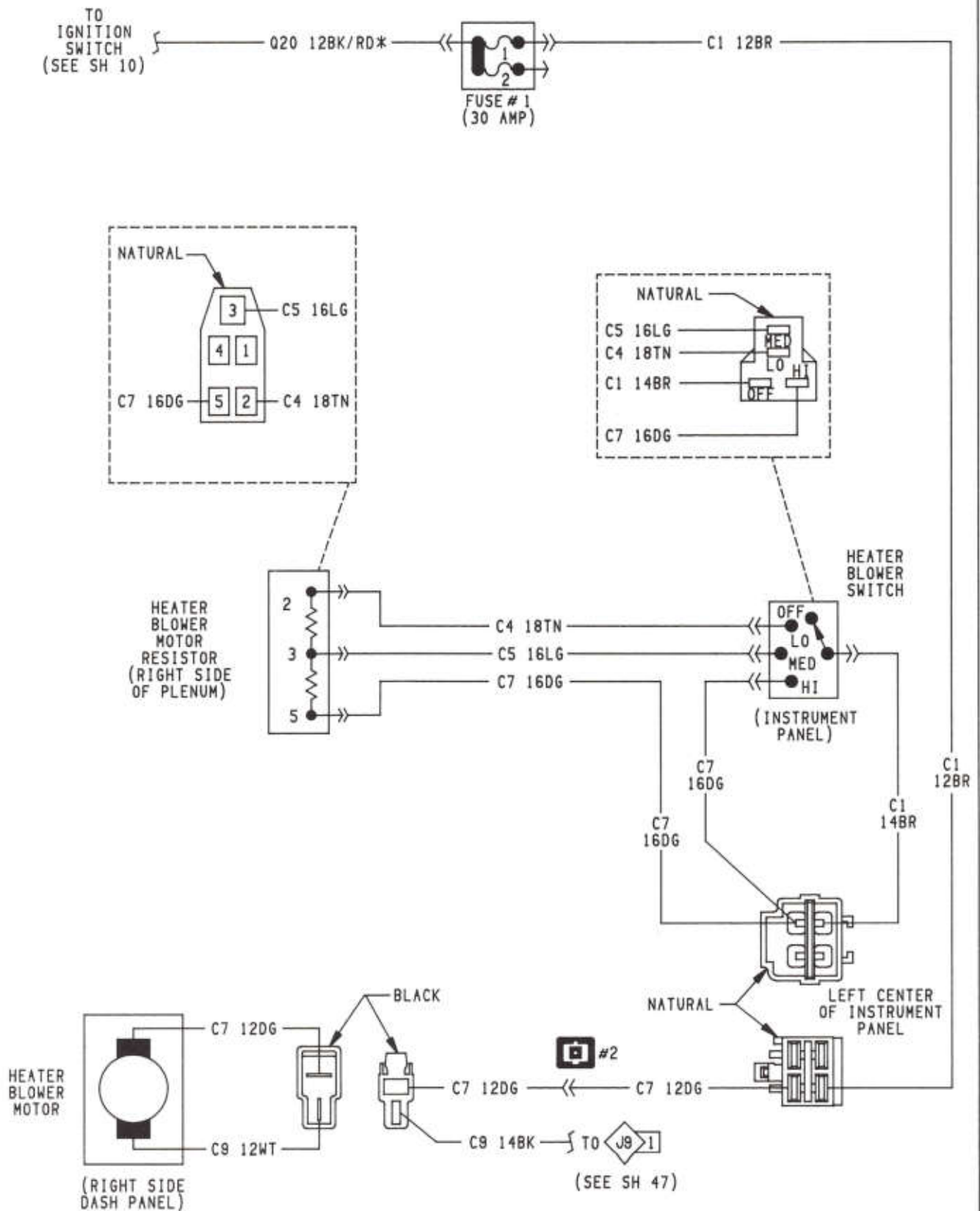




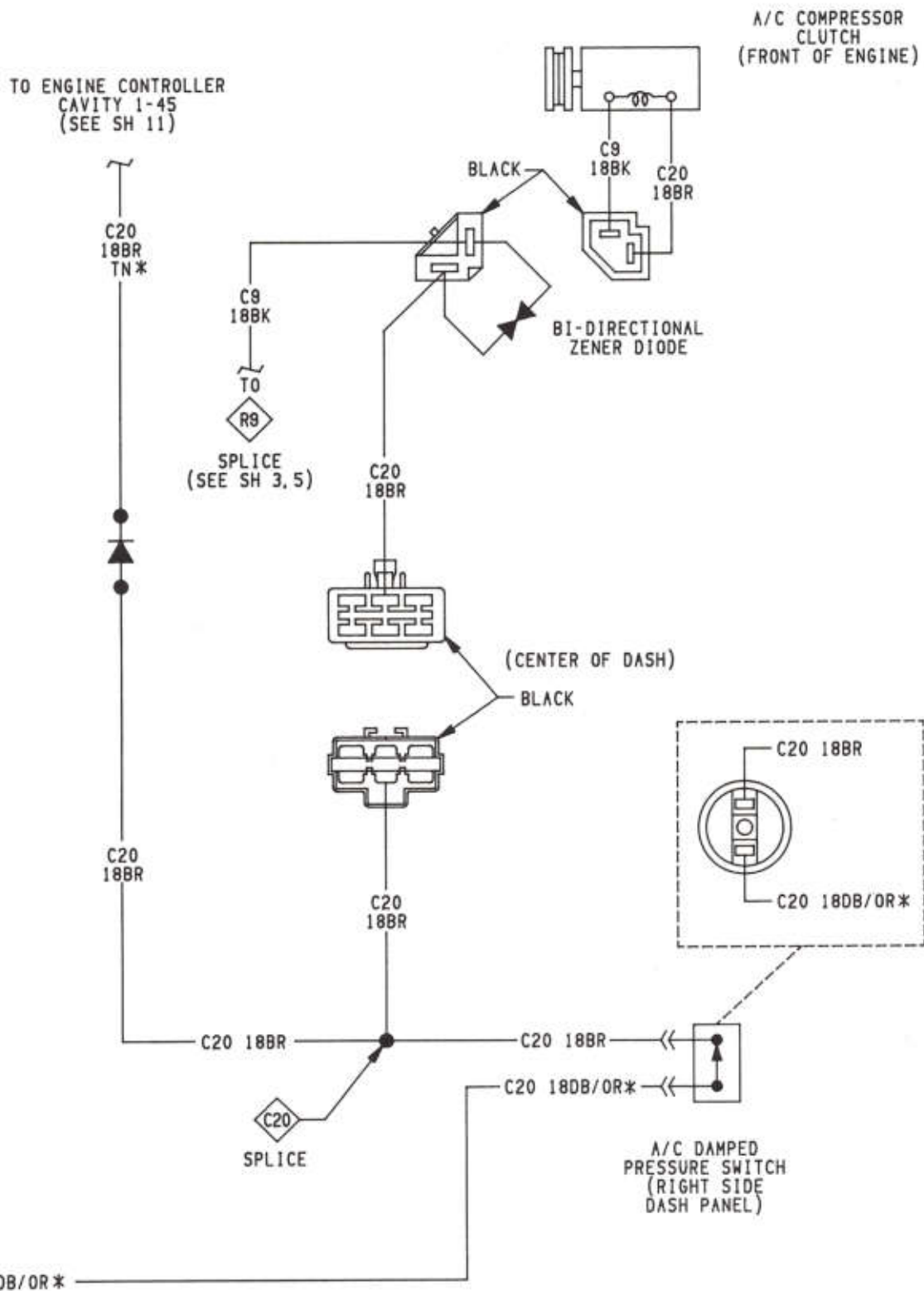


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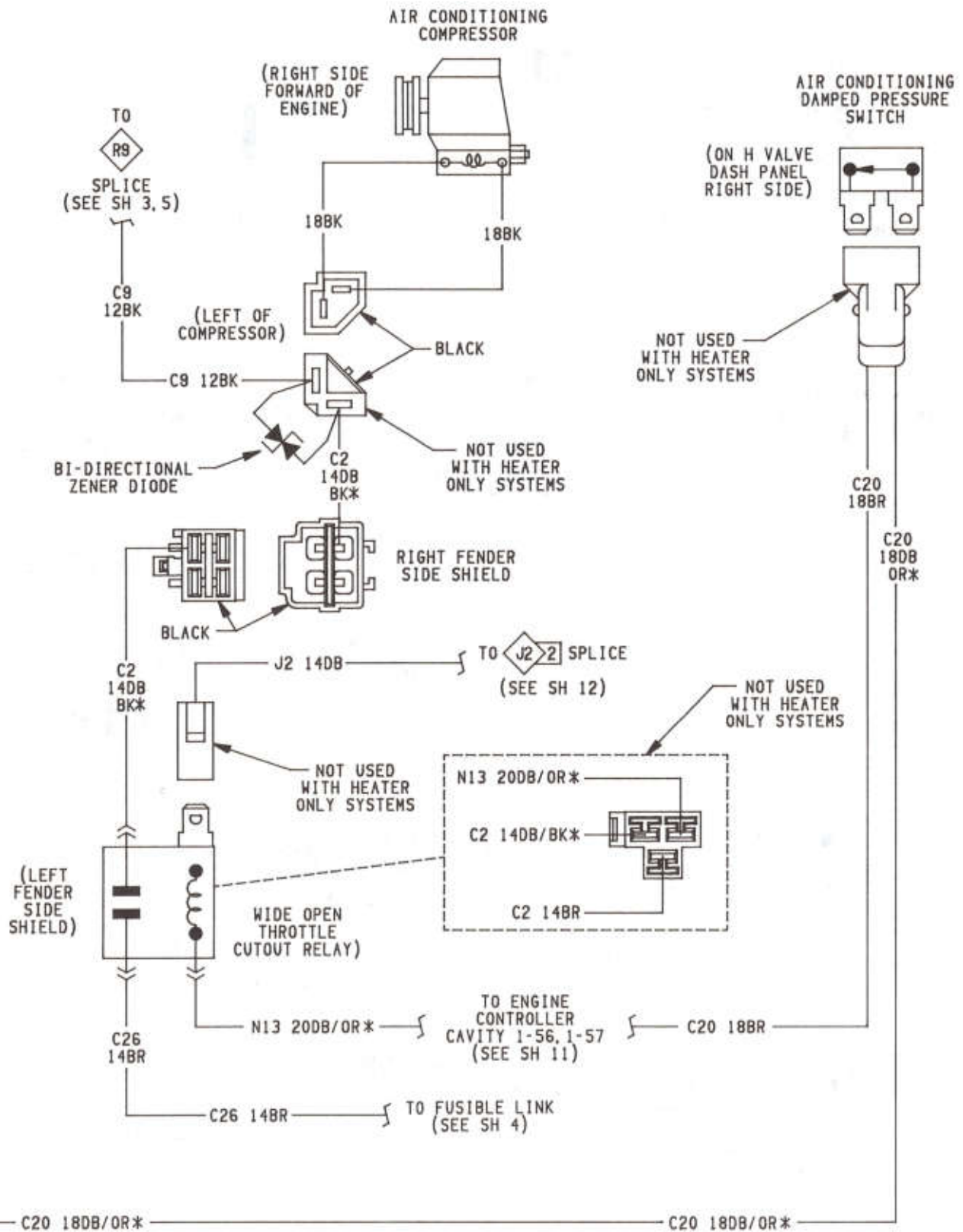












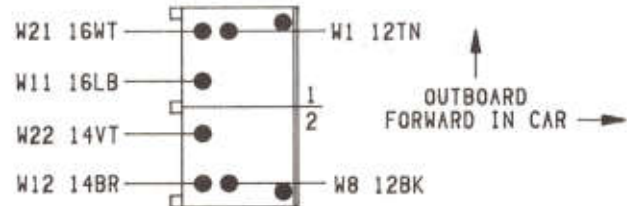
A/C AND HEATER-
ELECTRONIC FUEL INJECTION IGNITION



ELECTRIC WINDOW LIFT CONNECTOR AND SWITCH FUNCTIONS

LEFT DOOR

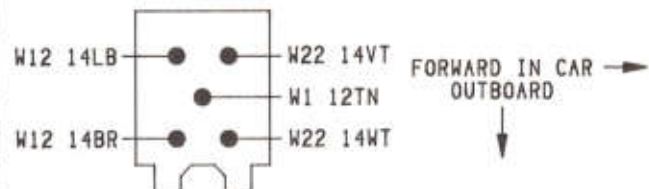
B+ POLARITY	B- POLARITY	SWITCH SELECT	WINDOW AND MOVEMENT
LB	WT	1	LEFT FRONT UP
WT	LB	1	LEFT FRONT DOWN
BR	VT	2	RIGHT FRONT UP
VT	BR	2	RIGHT FRONT DOWN
TN	BK	SWITCH	FEED AND GROUND



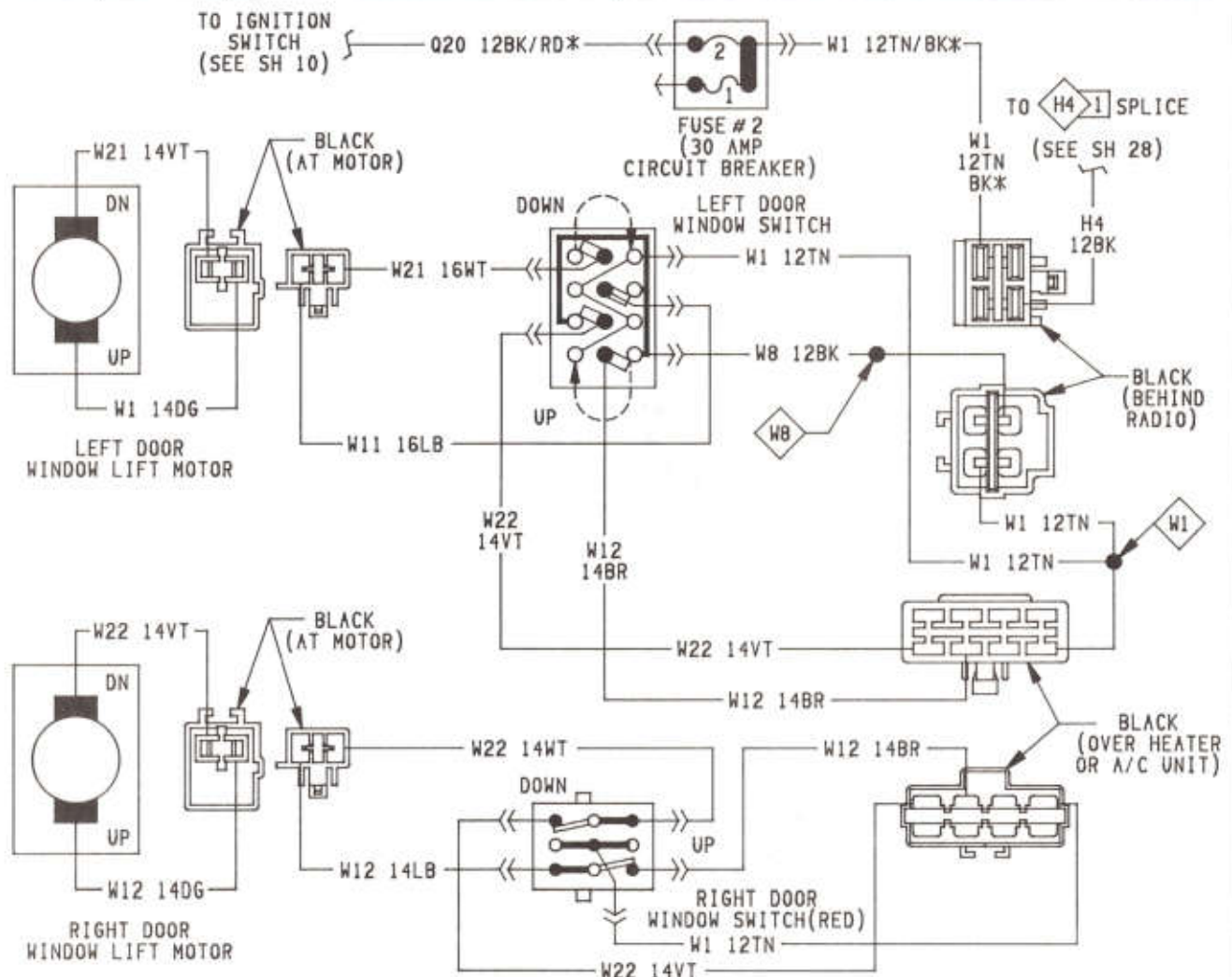
CONNECTOR GANG LEFT FRONT DOOR
MASTER SWITCH

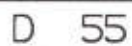
RIGHT DOOR

B+ POLARITY	B- POLARITY	WINDOW MOVEMENT AND SWITCH
WT	LB	DOWN FROM DOOR SWITCH
LB	WT	UP FROM DOOR SWITCH
VT	BR	DOWN FROM MASTER SWITCH
BR	VT	UP FROM MASTER SWITCH
TN	---	FEED

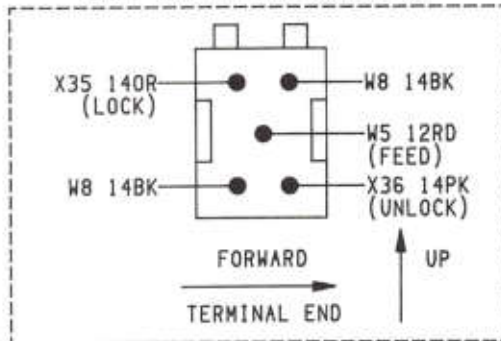


RIGHT FRONT WINDOW LIFT SWITCH CONNECTOR

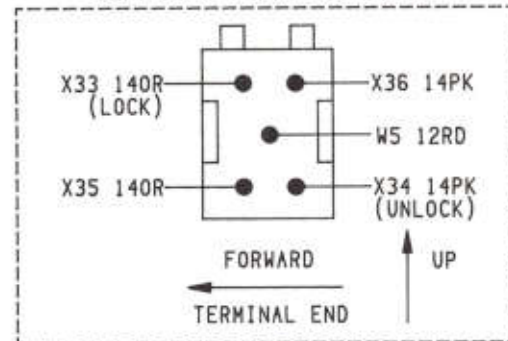




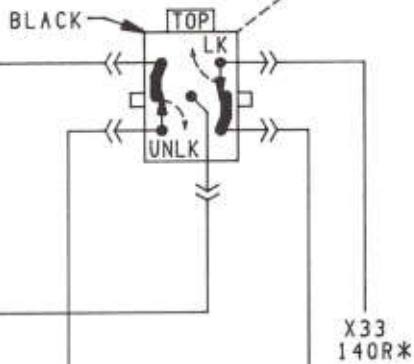
LEFT DOOR SWITCH CONNECTOR



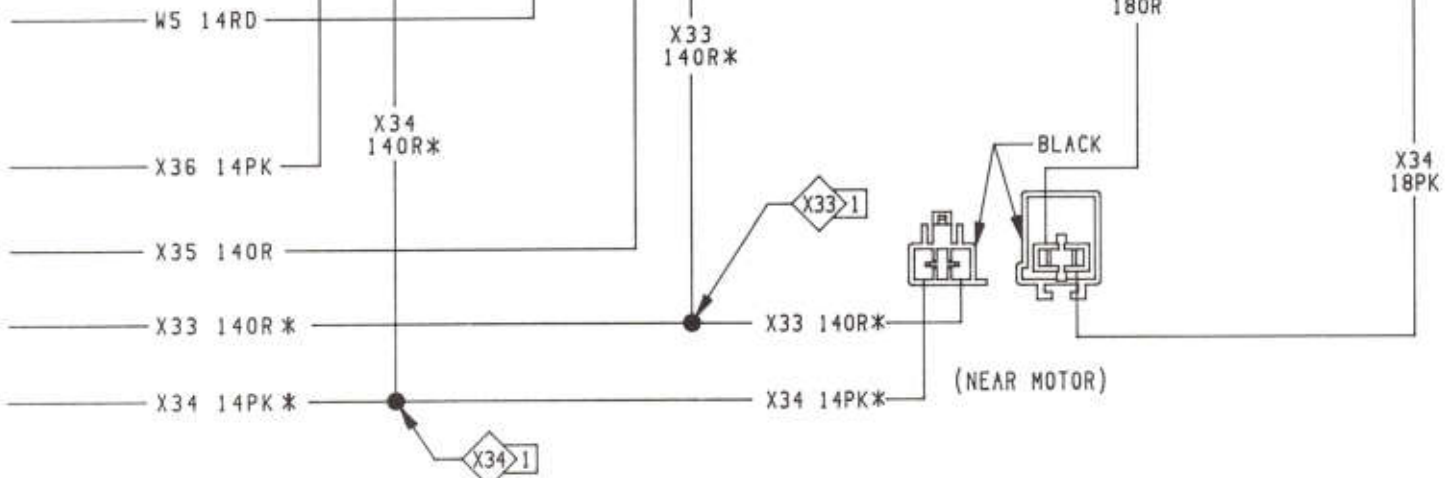
LEFT DOOR SWITCH CONNECTOR

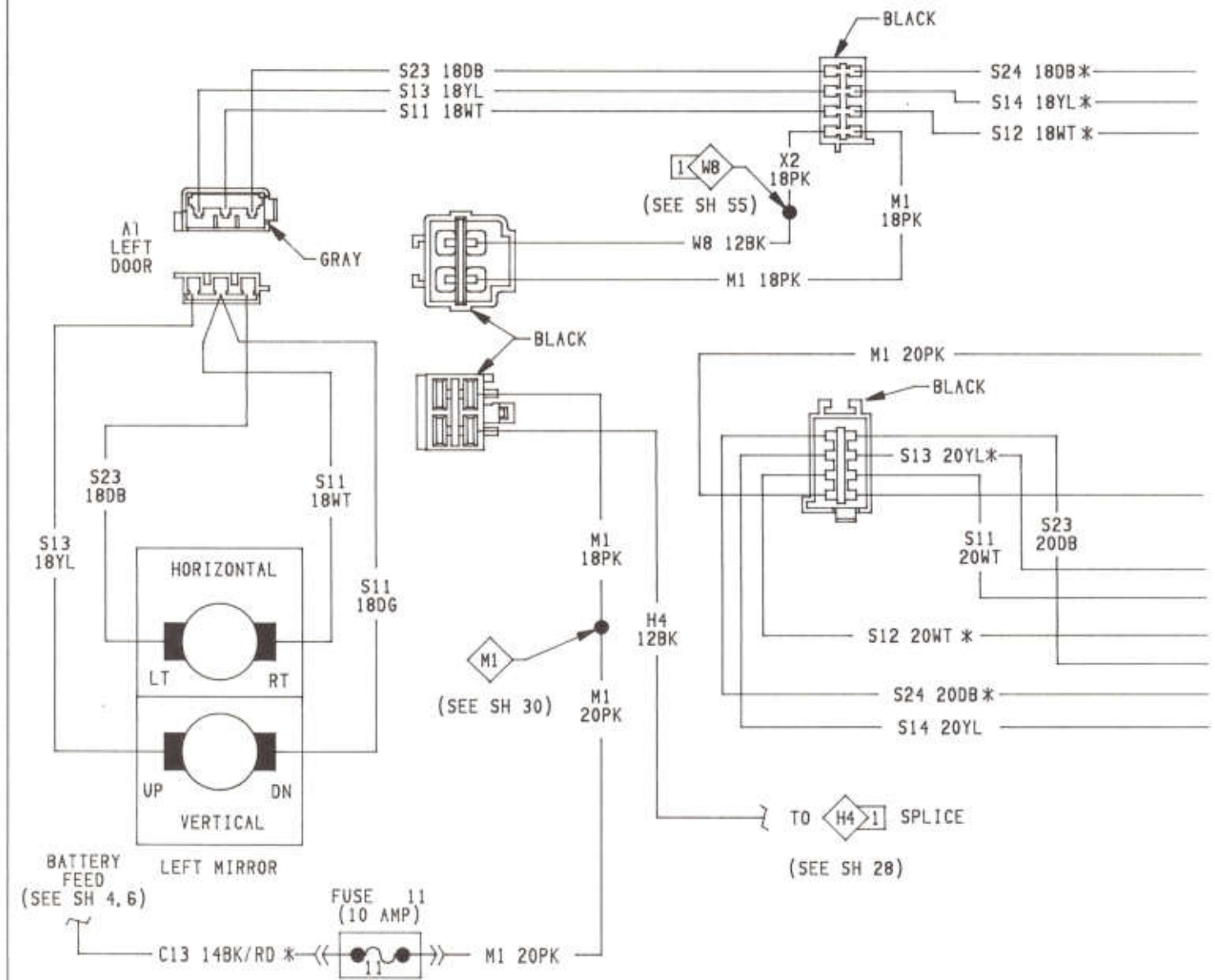


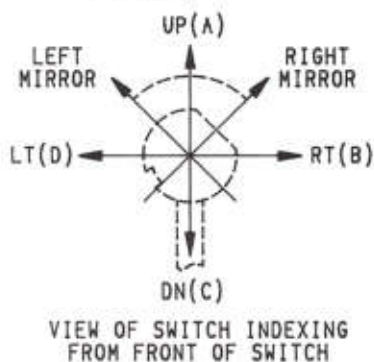
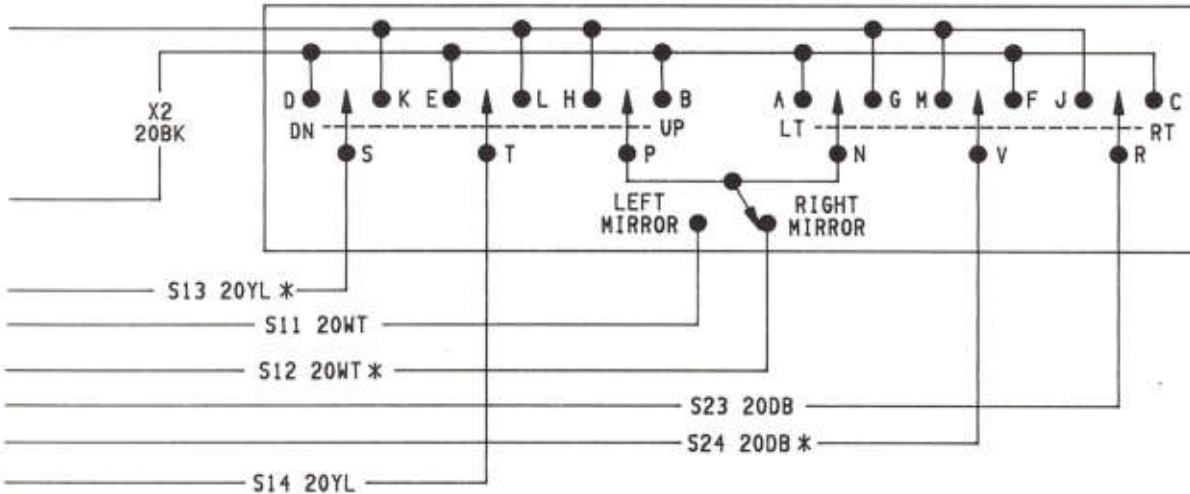
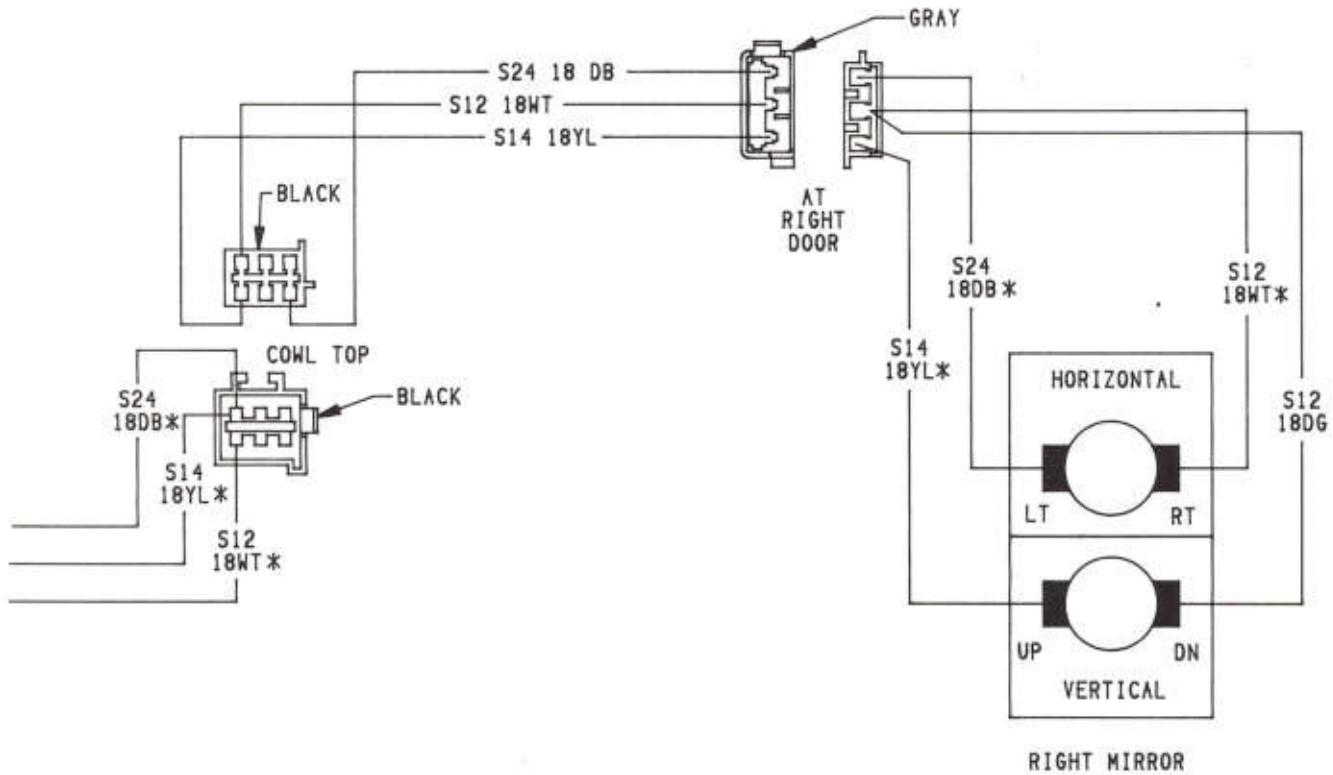
RIGHT FRONT DOOR SWITCH
(VIEW FROM
TERMINAL END)



RIGHT FRONT
DOOR MOTOR



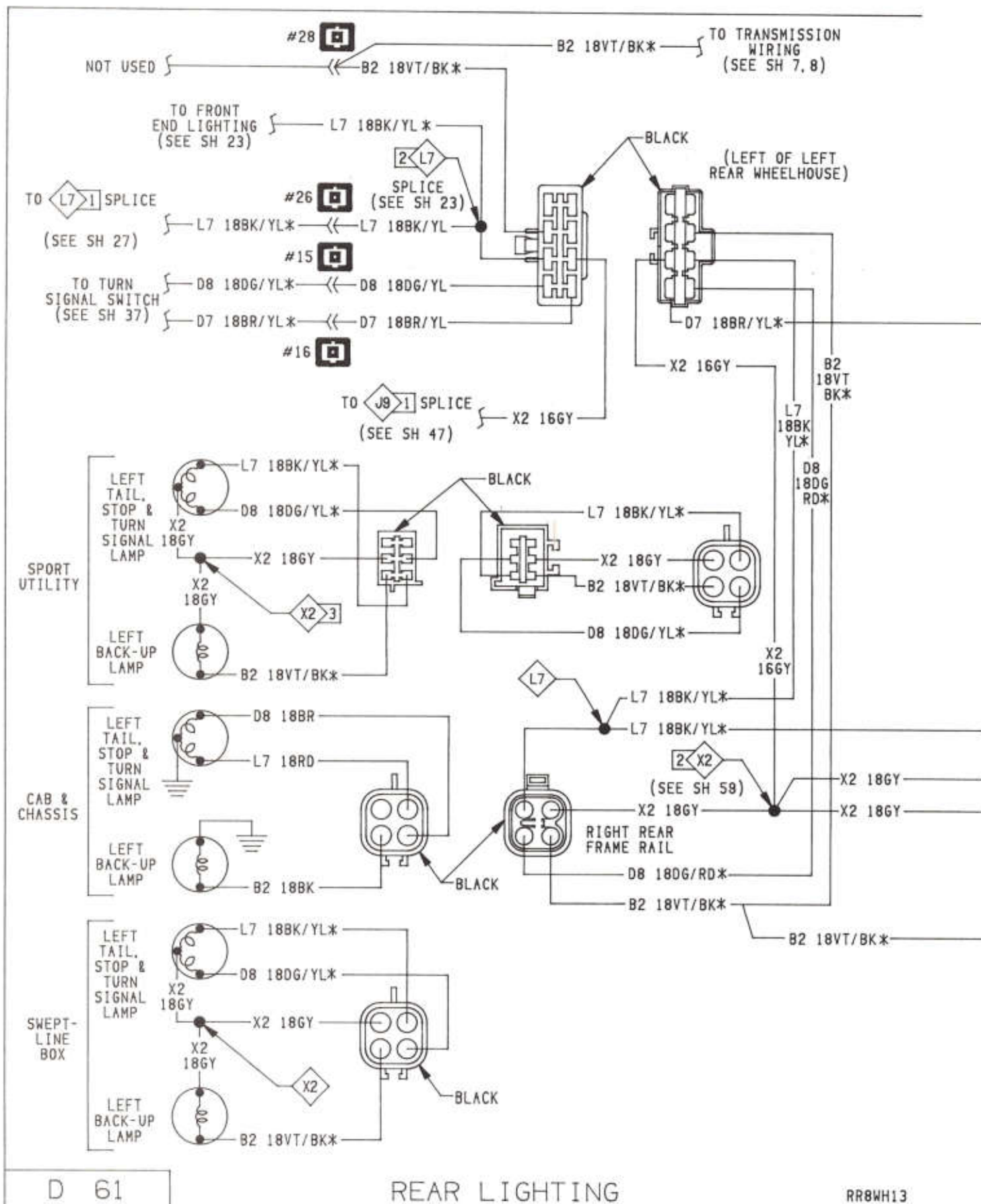


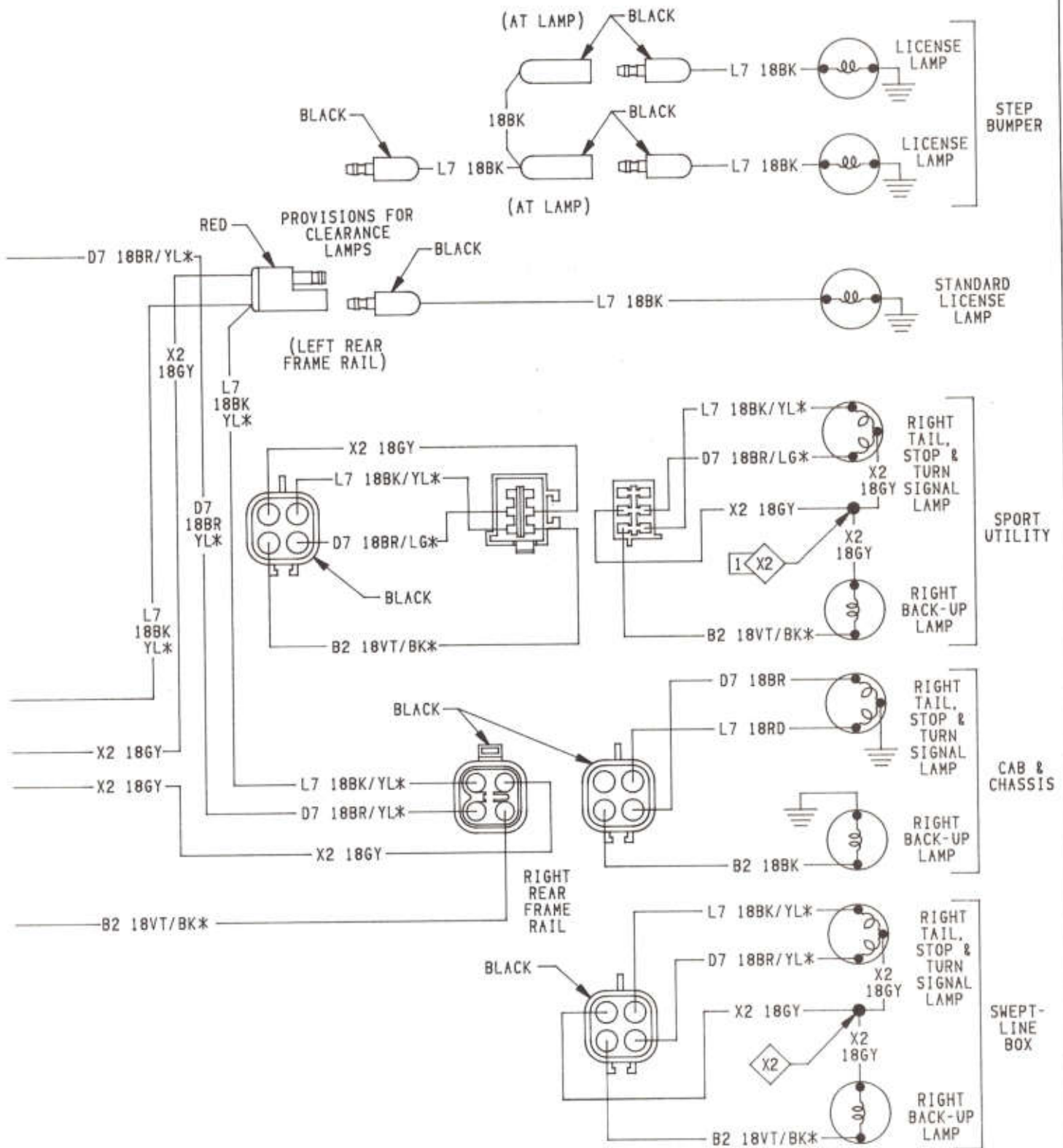


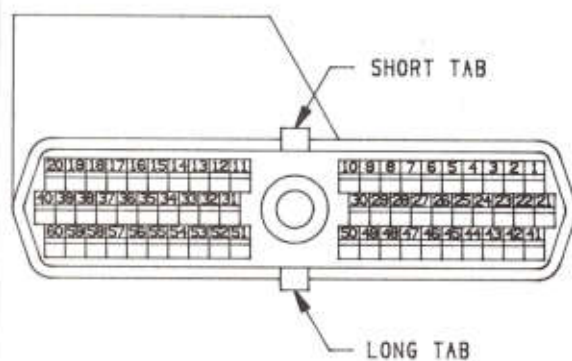
POWER MIRROR SWITCH FUNCTION		
LEVER POSITION	CIRCUIT	MIRROR DIRECTION
A	SK, TL, PB	UP
B	NG, VP, RC	RIGHT
C	SD, TE, PH	DOWN
D	NA, VM, RJ	LEFT







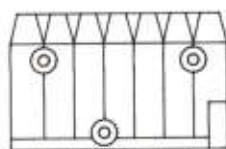
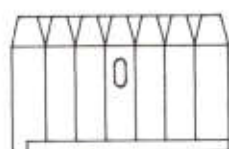




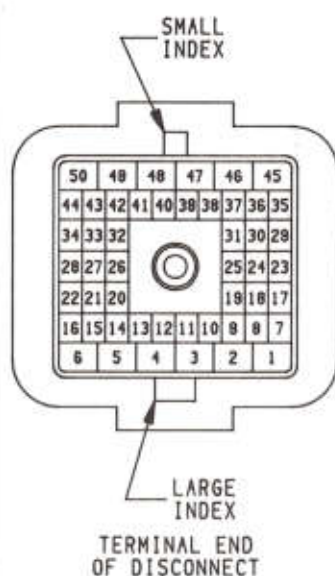
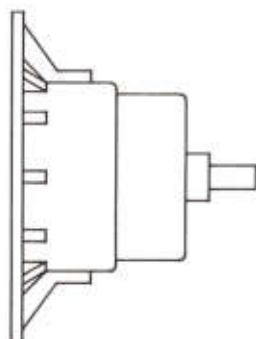
CONNECTOR #1
VIEWED FROM WIRE
END OF CONNECTOR

CAV	IGNITION SYSTEM CIRCUITS		SHEET NO.
1	K4 20DG/RD*	MAP SENSOR	14
2	—	—	—
3	K10 20TN/WT*	COOLANT SENSOR	14
4	N5 18BK/LB*	SENSOR RETURN	14
5	K5 16BK*	SIGNAL GROUND	11
6	—	—	—
7	—	—	—
8	—	—	—
9	—	—	—
10	Z1 16DG/BK*	Z1 INPUT	12
11	—	—	—
12	K14 18DB*	FJ2	12
13	K8 20VT*	5 VOLT SUPPLY	14
14	R31 20DG/OR*	ALT FIELD CONTROL	12
15	K9 18LB/RD*	POWER GROUND	11
16	K9 18LB/RD*	POWER GROUND	11
17	N2 18BR*	AUTOMATIC IDLE SPEED MOTOR	13
18	—	—	—
19	N1 18GY/RD*	AUTOMATIC IDLE SPEED MOTOR	13
20	—	—	—
21	—	—	—
22	K7 18OR/DB*	THROTTLE POSITION SENSOR	11
23	N11 18BK/DG*	OXYGEN SENSOR	11
24	—	—	—
25	—	—	—
26	N31 18VT	CLOSED THROTTLE SWITCH	13
27	—	—	—
28	—	—	—
29	D4 18WT/PK*	BRAKE SWITCH	13
30	S4 20BR/YL*	PARK/NEUTRAL SWITCH	13
31	DK20 20LG	SCI RECEIVE	11
32	Y1 20GY/WT*	INJECTOR CONTROL 2	12
33	K16 20VT/YL*	INJECTOR CONTROL 1	12
34	K15 20YL	DWELL CONTROL	13
35	—	—	—
36	—	—	—
37	—	—	—
38	U4 20OR/WT*	OVERDRIVE LOCKOUT	13
39	N23 20BK/OR*	AIR SWITCHING	11
40	S6 20GY/YL*	EGR SOLENOID	12
41	J1 16RD	DIRECT BATTERY	13
42	—	—	—
43	—	—	—
44	—	—	—
45	C20 18BR	A/C CLUTCH INPUT	11
46	—	—	—
47	N7 18GY/BK*	REFERENCE PICKUP	14
48	G7 20WT/OR*	VEH SPEED PICKUP	14
49	—	—	—
50	—	—	—
51	DK21 20PK	SCI TRANSMIT	11
52	N6 18OR	8 VOLT INPUT	14
53	—	—	—
54	K1 20PK*	PURGE SOLENOID	12
55	U3 20OR/BK*	LOCK-UP T/C	13
56	N13 20OB/OR*	A/C WOT C/O	11
57	—	—	—
58	DK19 20OB/YL*	ASD RELAY	11
59	K3 20BK/PK*	CHECK ENGINE	13
60	—	—	—

CONNECTOR # 2



CAV	IGNITION SYSTEM CIRCUITS		SHEET NO.
1	N6 180R	8 VOLT OUTPUT	14
2	K5 16BK*	SIGNAL GROUND	11
3	K14 18DB*	FJ2 OUTPUT	12
4	J2 14DB	J2 INPUT	12
5	Y1 20GY/WT*	INJECTOR DRIVER 2	12
6	J9 16BK	POWER GROUND	11
7	J9 16BK	POWER GROUND	11
8	K16 20VT/YL*	INJECTOR CONTROL 1	12
9	Y11 18WT	INJECTOR DRIVER 1	11
10	Y12 18TN	INJECTOR DRIVER 2	11
11	R31 20DG/OR*	ALT FIELD CONTROL	12
12	J5 18BK/YL*	IGNITION COIL DRIVER	12
13	K15 20YL	DWELL CONTROL	13
14	R3 18DG	ALT FIELD DRIVER	13



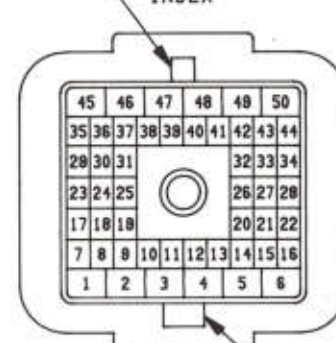
CAVITY	ENGINE COMPARTMENT CIRCUITS	
1	L1 12RD/WT*	HEADLAMP SWITCH
2	C7 12DG	A/C & HEATER BLOWER MOTOR
3	—	—
4	—	—
5	L4 16VT/WT*	HEADLAMP LOW BEAM
6	L3 14RD/OR*	HEADLAMP HIGH BEAM
7	X30 20DB/RD*	SPEED CONTROL
8	X31 20BR/RD*	SPEED CONTROL
9	X34 20WT/RD*	SPEED CONTROL
10	—	—
11	—	—
12	U4 200R/WT*	OVERDRIVE SWITCH
13	U40 200R/DB*	OVERDRIVE SOLENOID
14	—	—
15	D8 18DG/YL*	LEFT REAR TURN SIGNAL LAMP
16	D7 18BR/YL*	RIGHT REAR TURN SIGNAL LAMP
17	G20 20VT/YL*	WATER TEMPERATURE SENDING UNIT
18	G6 20GY	OIL PRESSURE SWITCH
19	G60 20GY/YL*	OIL PRESSURE SENDING UNIT
20	—	—
21	D6 18LG	LEFT TURN SIGNAL LAMP
22	D5 18TN	RIGHT TURN SIGNAL LAMP
23	A3 16PK	BATTERY-HAZARD FLASHER
24	—	—
25	—	—
26	L7 18BK/YL*	PARKING LAMPS
27	B1 18WT	BACK-UP LAMP SWITCH
28	B2 18VT/BK*	BACK-UP LAMP SWITCH
29	V10 20BR	WINDSHIELD WASHER MOTOR
30	—	—
31	S2 16YL	STARTER RELAY-IGNITION
32	H2 18DG/RD*	HORN
33	—	—
34	P5 20GY/BK*	BRAKE WARNING LAMP SWITCH
35	V5 18DG	WINDSHIELD WIPER MOTOR
36	V6 18DB	WINDSHIELD WIPER MOTOR
37	C2 18DB/OR*	AIR CONDITIONING DAMPED PRESSURE SWITCH
38	—	—
39	G4 20DB/YL*	FUEL TANK SENDING UNIT
40	X4 20LG/BR*	4 WHEEL DRIVE SWITCH
41	—	—
42	—	—
43	A11 20RD	AMMETER
44	R16 20BK	AMMETER
45	V3 18BR/WT*	WINDSHIELD WIPER MOTOR
46	V4 18RD/YL*	WINDSHIELD WIPER MOTOR
47	J2 14DB	SPLICE-IGNITION RUN CIRCUIT
48	C13 14BK/RD*	IGNITION OFF DRAW
49	J1 12RD	IGNITION SWITCH
50	J10 12PK*	IGNITION SWITCH

CAVITY	INSTRUMENT PANEL CIRCUITS		SHEET
1	L1 12RD*	BATTERY FEED	4, 6, 26
2	C7 12DG	A/C & HEATER BLOWER MOTOR	48, 49, 51
3	—	—	—
4	—	—	—
5	L40 16VT/WT*	HEADLAMP-LOW BEAM	23, 27
6	L30 14RD/OR*	HEADLAMP-HIGH BEAM	23, 27
7	X30 20DB/RD*	SPEED CONTROL	25
8	X31 22BR/RD*	SPEED CONTROL	25
9	X34 20WT/RD*	SPEED CONTROL	25
10	—	—	—
11	—	—	—
12	U4 200R/WT*	OVERDRIVE SWITCH	9
13	U40 200R/DB*	OVERDRIVE SOLENOID	9
14	—	—	—
15	D8 18DG/YL*	LEFT REAR SIGNAL LAMP	37, 60
16	D7 18BR/YL*	RIGHT REAR SIGNAL LAMP	37, 60
17	G20 20VT/YL*	TEMPERATURE-SEND/UNIT OR SWITCH	16, 18, 20, 21, 22
18	G6 20GY	OIL PRESSURE LAMP	2
19	G60 20GY/YL*	OIL PRESSURE GAUGE-SEND/UNIT	16, 18, 20, 21, 22
20	—	—	—
21	D6 18LG	LEFT FRONT TURN SIGNAL LAMP	23, 37
22	D5 18TN	RIGHT FRONT TURN SIGNAL LAMP	24, 37
23	A3 14PK/WT*	HAZARD FLASHER	3, 5, 37
24	—	—	—
25	—	—	—
26	L7 18BK/YL*	PARKING LAMPS	23, 27, 35, 61
27	B1 18WT	BACK-UP LAMP FEED	7, 8
28	—	USED AS TIE POINT ONLY	61
29	V10 20BR	WINDSHIELD WASHER MOTOR	45, 47
30	—	—	—
31	S2 14YL	IGNITION START	8, 10, 15, 17
32	H2 18DG/RD*	HORNS	26
33	—	—	—
34	P5 20GY/BK*	BRAKE WARNING LAMP	21
35	V5 18DG	WINDSHIELD WIPER SWITCH	46, 47
36	V6 18DB	WINDSHIELD WIPER SWITCH	47
37	C2 18DB/OR*	A/C CLUTCH	51
38	K3 20BK/PK*	CHECK ENGINE LAMP	13
39	G4 20DB/YL*	FUEL TANK SENDING UNIT	59, 60
40	X4 20LG/BR*	4 WHEEL DRIVE SWITCH	53
41	D4 18WT/PK*	BRAKE SENSOR	37
42	—	—	—
43	A11 16RD	AMMETER	3, 5
44	R16 16BK	AMMETER	3, 5
45	V3 18BR/WT*	WINDSHIELD WIPER LOW SPEED	46, 47
46	V4 18RD/YL*	WINDSHIELD WIPER HIGH SPEED	46, 47
47	J2 14DB	IGNITION-RUN & START	5, 10, 12, 16, 18, 20, 25, 53, 59, 60
48	C13 14BK/RD*	BATTERY FEED	4, 6
49	J1 12RD	IGNITION SWITCH (B1)	4, 6, 10, 37
50	J10 12PK/BK*	IGNITION SWITCH (B3)	4, 6, 10

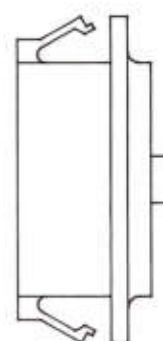


TERMINAL END
OF DISCONNECT

SMALL
INDEX

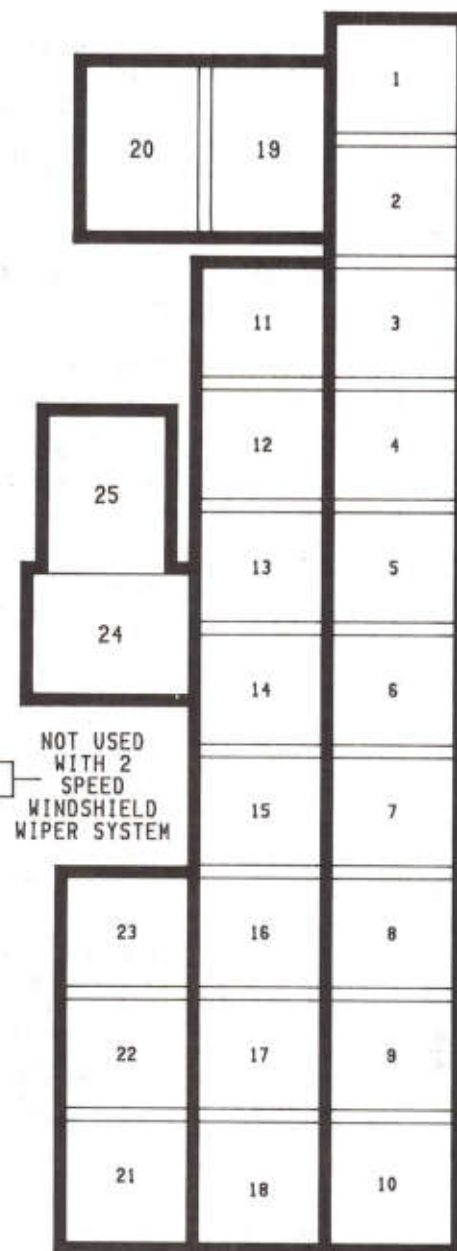


LARGE
INDEX



VIEWED FROM WIRE END

CAV	CIRCUIT	DESCRIPTION
1	—	—
2	H4 18BK (2)	HORN AND KEY-IN LAMP GROUND (STANDARD COLUMN)
3	H3 22BK/RD*	GROUND FROM HORN SWITCH
4	D6 18LG	LEFT FRONT TURN SIGNAL
5	D5 18TN	RIGHT FRONT TURN SIGNAL
6	D32 18PK*	HAZARD FLASHER FEED
7	D2 18RD/BK*	FEED FROM TURN SIGNAL FLASHER
8	D8 18DG/YL*	LEFT REAR TURN SIGNAL
9	D7 18BR/YL*	RIGHT REAR TURN SIGNAL
10	D4 18WT/PK* (2)	FEED FROM BRAKE SWITCH
11	—	—
12	V3 18BR*	WINDSHIELD WIPER LOW SPEED
13	V4 18RD/YL*	WINDSHIELD WIPER HIGH SPEED
14	V5 18DG	WINDSHIELD WIPER MOTOR
15	V6 18DB	WINDSHIELD WIPER SWITCH FEED
16	V10 20BR	WINDSHIELD WASHER MOTOR
17	H4 18BK (2)	INTERMITTENT WIPE SWITCH GROUND
18	H40 18BK/LG*	INTERMITTENT WIPE MODULE GROUND
19	M26 20LB	KEY-IN BUZZER
20	M16 20BK/LB*	LEFT FRONT DOOR JAMB SWITCH GROUND
21	—	—
22	—	—
23	—	—
24	J15 20YL/RD*	IGNITION KEY LAMP FEED
25	H4 20BK	IGNITION KEY LAMP GROUND



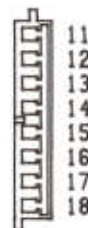
(LEFT OF STEERING COLOUM)

INSTRUMENT PANEL TO
STEERING COLUMN WIRING

CAVITY	DESCRIPTION	SHEET
1	—	—
2	H4 188K	HORN AND KEY-IN LAMP GROUND 26, 28, 45
3	H3 208K/RD*	HORN SWITCH GROUND 26
4	D6 18LG	LEFT FRONT TURN SIGNAL 23, 37
5	D5 18TN	RIGHT FRONT TURN SIGNAL 24, 37
6	D32 16PK	HAZARD FLASHER FEED 37
7	D2 18RD/BK*	TURN SIGNAL FLASHER FEED 37
8	D8 18DG/RD*	LEFT REAR TURN SIGNAL 37
9	D7 18BR/RD*	RIGHT REAR TURN SIGNAL 37
10	D4 16WT	BRAKE SWITCH FEED 37

TURN SIGNAL
SWITCH
CONNECTOR

11	—	—	
12	V3 18BR*	INTERMITTENT WIPE MODULE	45, 47
	V3 18BR*	WINDSHIELD WIPER LOW SPEED	
13	V4 18RD	WINDSHIELD WIPER HIGH SPEED	45, 47
14	V5 18DG	INTERMITTENT WIPE MODULE	45, 47
	V5 18DG	WINDSHIELD WIPER MOTOR	
15	V6 18DB	WINDSHIELD WIPER SWITCH FEED	45, 47
16	V10 18BR	INTERMITTENT WIPE MODULE	45, 47
	V10 18BR	WINDSHIELD WASHER MOTOR	
17	H4 188K	INTERMITTENT WIPE SWITCH GROUND	26, 28, 45
18	H40 18BK/LG*	INTERMITTENT WIPE MODULE GROUND	28, 46

WINDSHIELD
WIPER SWITCH
CONNECTOR

19	M26 20LB	KEY-IN BUZZER OR CHIME	30
20	M16 20BK/LB*	LEFT FRONT DOOR JAMB SWITCH GROUND	30

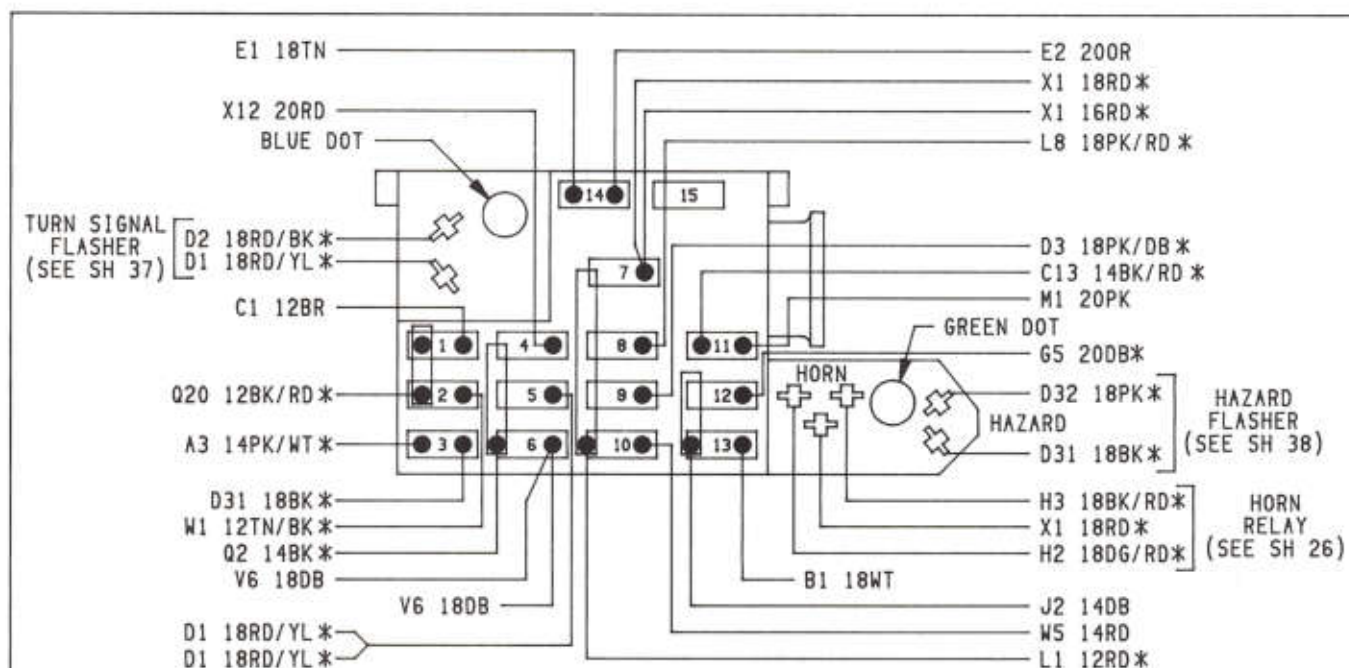
KEY-IN BUZZER
SWITCH CONNECTOR

24	J15 18YL*	IGNITION KEY LAMP FEED	30
25	H4 188K	IGNITION KEY LAMP GROUND (TILT COLUMN)	26, 28, 30, 45

IGNITION KEY LAMP
SWITCH CONNECTOR

(PLUGGED INTO STEERING COLUMN
25 WAY CONNECTOR)

STEERING COLUMN SWITCH
TO PANEL WIRING



FUSE NUMBER	AMPS	COLOR STRIPE	SHEET
1	30	GREEN	2, 10, 48, 49, 51
2	30 CIRCUIT BREAKER	SILVER CAN	2, 10, 54
3	20	YELLOW	1, 37
4	10	RED	2, 10, 37, 41, 42, 43
5	20	YELLOW	2, 10, 33, 37
6	20	YELLOW	2, 10, 37, 46, 47
7	20	YELLOW	1, 4, 6, 26, 31
8	20	YELLOW	1, 4, 6, 27
9	20	YELLOW	1, 4, 6, 25, 26, 28
10	30 CIRCUIT BREAKER	SILVER CAN	1, 4, 6, 55
11	10	RED	2, 4, 6, 29, 30, 31, 41, 42, 43, 57
12	5	TAN	2, 5, 9, 10, 16, 18, 20, 25, 53, 59, 60
13	20	YELLOW	2, 5, 7, 8, 16, 18, 20
14	3	VIOLET	1, 9, 27, 31, 41, 42, 43
15	—	—	

ENGINE

CONTENTS

	Page		Page
SIX CYLINDER (3.9L-V6) ENGINE	7	EIGHT CYLINDER (318-360) V8 ENGINES	37
3.9L-SPECIFICATIONS	31-34	318-360 SPECIFICATIONS	62-66
3.9L-TIGHTENING REFERENCE	35-36	318-360 TIGHTENING REFERENCE	67
STANDARD SERVICE PROCEDURES	1		

STANDARD SERVICE PROCEDURES

INDEX

	Page		Page
Checking Engine Oil Pressure	4	Honing Cylinder Bores	2
Crankcase Ventilation System	2	Inspection for Engine Oil Leaks	4
Engine Diagnosis	5	Measuring Main and Connecting Rod Bearing Clearance	3
Engine Performance	1	Repair of Damaged or Worn Threads	4
Form-In-Place Gaskets	1		

FORM-IN-PLACE GASKETS

There are several places where RTV (Room Temperature Vulcanizing) gasket/sealing material is used throughout the engine. Where this material is used, generally at corners of sealing gaskets and rear main bearing oil seal retainer, care must be taken to assure obtaining the desired results. Bead size continuity, and location are of great importance. Too much can result in spill over which can break off and obstruct fluid feed lines.

RTV

RTV silicone, normally black in color, is available in three ounce tubes. Moisture in the air causes the RTV material to cure. This material is normally used on flexible metal flanges. It has a shelf life of one year and will not properly cure if over age. Always inspect the package for the expiration date before using.

Surface Preparation

Scrape clean or wire brush all gasket surfaces removing all loose material. Inspect stamped parts to assure gasket rails are flat. Flatten rails with a hammer on a flat plate if required. Gasket surfaces must be free of oil and dirt. Make sure old gasket material is removed from blind attaching holes.

Form-In-Place RTV Application

The RTV material should be applied in a continuous bead approximately 3mm (.12 in.) in diameter. All mounting holes must be circled. For "corner" sealing a 1/8" or 1/4" drop is placed in the center of the gaskets contact area. Uncured RTV may be removed with a rag. Components should be torqued in place while the RTV is still wet to the touch (within 10

minutes). The usage of a locating dowel is recommended during assembly to prevent smearing the material off location.

ENGINE PERFORMANCE 6 and 8 Cylinder Engines

To provide best vehicle performance and lowest vehicle emissions, it is most important that the tune-up be done accurately, using the specifications listed on the Vehicle Emission Control Information label found in each engine compartment.

(1) Test battery specific gravity, add water if necessary, clean and tighten battery connections.

(2) Test cranking amperage draw. See "Starting Motor Cranking Amperage Draw" Electrical Section of this manual.

(3) Tighten the intake manifold bolts to specifications.

(4) Perform cylinder compression test.

a. Check engine oil level and add oil if necessary.

b. Drive the vehicle until engine reaches normal operating temperature.

c. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times ... briskly.

CAUTION: Do not overspeed the engine. The higher engine speed may help clean out valve seat deposits which can prevent accurate compression readings.

d. Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators—fouled, hot, oil, etc. Record cylinder number of spark plug for future reference.

e. Disconnect coil wire from distributor and secure to good ground to prevent a spark from starting a fire.

f. Be sure choke and throttle blades are fully

open during the compression check.

g. Insert compression gauge adaptor into the #1 spark plug hole in cylinder head. Crank engine until maximum pressure is reached on gage. Record this pressure as #1 cylinder pressure.

h. Repeat Step "g" for all remaining cylinders.

i. Compression should not be less than 100 psi (689 kPa) and not vary more than 25% from cylinder to cylinder.

j. If one or more cylinders have abnormally low compression pressures, repeat steps 4a through 4h.

k. If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question.

The recommended compression pressures are to be used only as a guide to diagnosing the engine problems. An engine should NOT be disassembled to determine the cause of low compression unless some malfunction is present.

(5) Clean or replace spark plugs as necessary and adjust gap. See Electrical, Group 8, for gap adjustment and torque.

(6) Test resistance of spark plug cables. Refer to "Ignition System Secondary Circuit Inspection" Electrical Section.

(7) Inspect the primary wire and vacuum advance operation. Test coil output voltage, primary and secondary resistance. Replace parts as necessary. Refer to Ignition System and make necessary adjustment.

(8) Reset ignition timing with vacuum advance line disconnected. Ignition timing should be set to specifications. (See specification label in engine compartment.)

(9) Set carburetor idle mixture adjustment. Adjust throttle stop screw to specifications. Perform a combustion analysis.

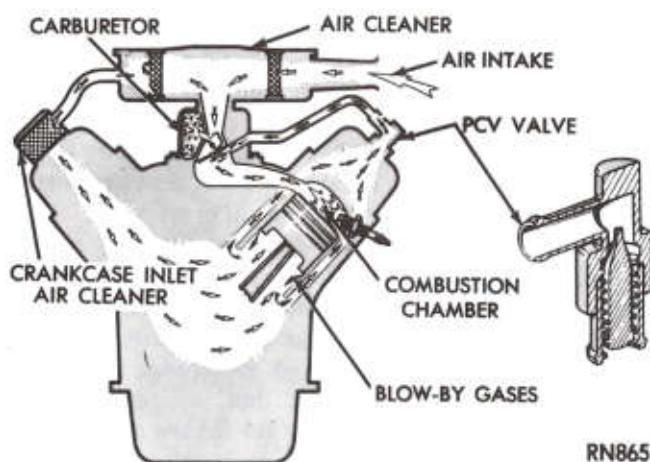


Fig. 1—Typical Closed Crankcase Ventilation System

(10) Test fuel pump for pressure and vacuum. Refer to "Fuel System" Group 14, Specifications.

(11) Inspect manifold heat control valve in exhaust manifold for proper operation and apply Manifold Heat Control Valve Solvent to bushing and shaft.

(12) The air filter element should be serviced as recommended in "Lubrication and Maintenance," Group 0.

(13) Inspect crankcase ventilation system as outlined. For emission controls see Emission Control Systems Group 25 for service procedures.

(14) Inspect and adjust accessory belt drives referring to "Cooling System," Group 7 for proper adjustments.

(15) Road test vehicle as a final test.

CRANKCASE VENTILATION SYSTEM

A fully closed crankcase ventilation system is installed on all engines. The system operates on air drawn in from the air cleaner and through the crankcase inlet air cleaner by means of a hose (Fig. 1).

Air is circulated through the engine and drawn out of the cylinder head cover, through the PCV valve, and into the combustion chamber by engine vacuum. There it is burned and dispelled with the exhaust gases.

The function of the PCV valve in this system is to regulate the amount of flow through the engine. Too much air flow will lean out the fuel air mixture, too little will allow pressurization of the crankcase. It is important therefore to keep the valve clean and operating.

The valve and hose are subject to fouling with sludge and carbon formation due to the nature of the material carried by the ventilation system. The valve will operate effectively as long as normal maintenance is applied.

A plugged vent system may in turn cause excessive engine crankcase sludge formation and may also cause rough or erratic engine idle or excessive oil leakage. The ventilation system should be cleaned and the PCV valve replaced, depending on time, mileage or type of service. See the "Lubrication and Maintenance" section, Group 0 of this manual for proper time intervals and service procedures.

HONING CYLINDER BORES

Before honing, stuff plenty of clean rags under the bores, over the crankshaft to keep abrasive materials from entering crankcase area.

(1) Used carefully, the cylinder bore resizing hone Tool C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round as well as removing light

scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.

(2) Deglazing of the cylinder walls may be done using a cylinder surfacing hone, Tool C-3501, equipped with 280 grit stones (C-3501-3810). If the cylinder bore is straight and round 20-60 strokes depending on the bore condition will be sufficient to provide a satisfactory surface. Inspect cylinder walls after each 20 strokes. Using honing oil C-3501-3880 or a light honing oil available from a major oil distributor. **Do not use engine or transmission oil, mineral spirits or kerosene.**

(3) Honing should be done by moving hone up and down fast enough to get a cross hatch pattern. When hone marks intersect at 50-60 degrees, cross hatch angle is most satisfactory for proper seating of rings. (Fig. 2).

(4) A controlled hone motor speed between 200-300 RPM is necessary to obtain the proper cross-hatch angle. The number of up and down strokes per minute can be regulated to get the desired 50-60 degree angle. (Faster up and down strokes increase the cross-hatch angle).

(5) After honing, it is necessary that block be cleaned again to remove all traces of abrasives.

CAUTION: Be sure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil bores after cleaning to prevent rusting.

MEASURING MAIN BEARING CLEARANCE AND CONNECTING ROD BEARING CLEARANCE

Plastic-Gage Method

Engine crankshaft bearing clearances can be deter-

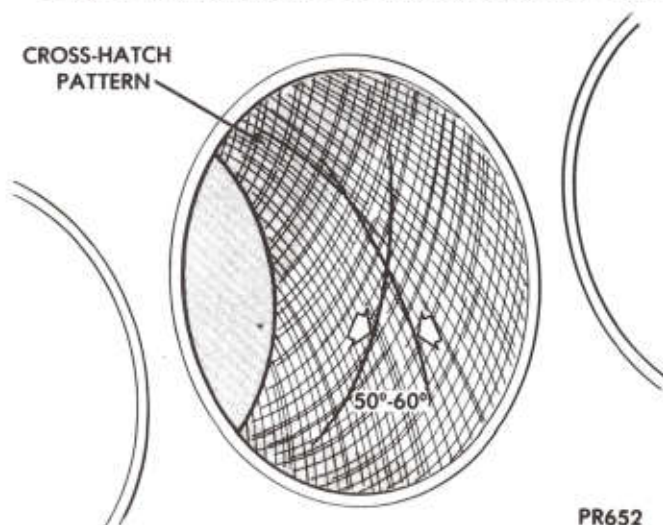


Fig. 2—Cross Hatch Pattern

mined by use of Plastic-Gage or equivalent. The following is the recommended procedure for the use of Plastic-Gage:

(1) Remove oil film from surface to be checked. (Plastic-Gage is soluble in oil).

(2) The total clearance of the **main bearings** can only be determined by removing the weight of the crankshaft. This can be accomplished by either of two methods:

a. With the weight of the crankshaft being supported by a jack under the counterweight adjacent to the bearing being checked.

b. **(Preferred method)** Shimming the bearings adjacent to the bearing to be checked in order to remove the clearance between upper bearing shell and the crankshaft. This can be accomplished by placing a minimum of .010 inch (0.254mm) shim (e.g. cardboard, matchbook cover, etc.) between the bearing shell and the bearing cap on the adjacent bearings and snugging bolts to 10-15 ft. lb. (14-20 N-m).

When checking #1 main brg. shim #2 main brg.

When checking #2 main brg. shim #1&3 main brg.

When checking #3 main brg. shim #2&4 main brg.

When checking #4 main brg. shim #3&5 main brg.

When checking #5 main brg. shim #4 main brg.

When checking #4 main brg. shim #3 main brg. (6-cyl. only).

ALL SHIMS MUST BE REMOVED BEFORE REASSEMBLING ENGINE.

(3) Place a piece of plasti-gage across the entire width of the bearing shell in the cap approximately 1/4" (6.35mm) off center and away from the oil holes (Fig. 3). (In addition, suspect areas can be checked by placing the Plastic-Gage in the suspect area). Torque the bearing cap bolts of the bearing being checked to the proper specifications, 85 ft. lb. (115 N-m).

The checking of connecting rod clearances does not require shimming of the crankshaft. However, before assembling the rod cap with Plastic-Gage in place, the crankshaft must be turned until the connecting rod to be checked starts moving toward the top of the engine. Only then should the cap be assembled and torqued to specifications, 45 ft. lb. (61 N-m). Do not rotate the crankshaft while assembling.

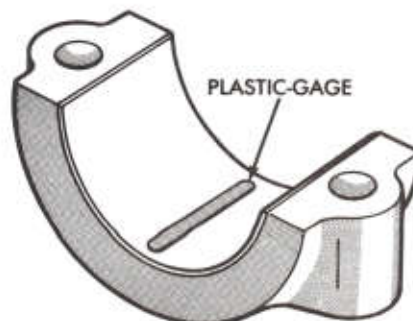
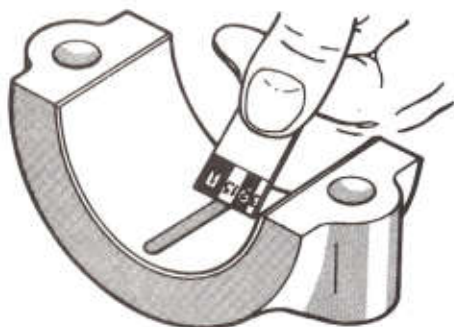


Fig. 3—Plastigage Placed in Lower Shell



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Fig. 4—Clearance Measurement

bling the cap or the Plastic-Gage may be smeared, giving inaccurate results.

(4) Remove the bearing cap and compare the width of the flattened Plastic-Gage (Fig. 4) with inch scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of an inch. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to the Engine Specifications for proper specifications.

Plastic-Gage generally is accompanied by two scales. One scale is in inches, the other is a metric scale. Care should be taken to use only the inch scale.

(5) Plastic-Gage is available in a variety of clearance ranges. The .001"-.003" (0.025-0.076mm) is usually the most appropriate for checking engine bearing clearances.

CHECKING ENGINE OIL PRESSURE

(1) Remove oil pressure sending unit with (Miller Tool Number C-4597).

(2) Install oil pressure line and gauge (Miller Tool Number C-3292). Start engine and record pressure. Refer to engine specification (engine lubrication) for proper pressures.

REPAIR OF DAMAGED OR WORN THREADS

Damaged or worn threads can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special tap, and installing an insert into the tapped hole. This brings the hole back to its original thread size.

INSPECTION FOR ENGINE OIL LEAKS

If an oil leak source is not readily identifiable, the following steps should be followed.

(1) Attach air hose with pressure gauge and regulator to the dipstick tube.

(2) Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug the breather cap nipple.

(3) Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.

(4) After the engine is sealed, set the air pressure regulator **no higher than 4 psi**.

(5) Using a liquid soap solution or preferable a stethoscope inspect all suspected oil leak areas. If an oil leak area is detected, repair per the service manual instructions.

(6) If no leaks are detected, turn off the air supply and remove the air hose and all plugs. Reinstall the PCV valve and breather cap hose. See step 7 and check for higher pressure leaks occurring during normal engine operation.

(7) Clean the oil off of the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 15 miles. Check the engine for signs of an oil leak. If an oil leak is found, repair per the service manual instructions.

Crankshaft Rear Oil Seal

Where crankshaft rear seal leakage is suspected raise vehicle and remove torque converter or clutch housing cover and inspect rear of block for evidence of oil.

A circular spray pattern generally indicates seal leakage.

Where leakage tends to run straight down, possible causes are a porous block and the rear cam and gally plugs.

If no leaks are detected while the crankcase is pressurized (4 psi), very slowly turn the crankshaft and watch for leakage. If a leak is detected while turning the crankshaft, it's possible the crankshaft seal surface is damaged in the seal area, minor nicks or scratches can be polished out with emery cloth. See "REAR MAIN BEARING OIL SEALS", this Group for proper seal installation.

ENGINE DIAGNOSIS

Condition	Possible Cause	Correction
ENGINE WILL NOT START	(a) Weak battery. (b) Corroded or loose battery connections. (c) Faulty starter. (d) Moisture on ignition wires and distributor cap. (e) Faulty ignition cables. (f) Faulty coil or control unit. (g) Incorrect spark plug gap. (h) Incorrect ignition timing. (i) Dirt or water in fuel system. (j) Carburetor flooded. (k) Incorrect carburetor float setting. (l) Faulty fuel pump. (m) Carburetor (if equipped) percolating. No fuel in the carburetor.	(a) Test battery specific gravity. Recharge or replace as necessary. (b) Clean and tighten battery connections. Apply a coat of light mineral grease to terminals. (c) Refer to "Electrical", Group 8. (d) Wipe wires and cap clean and dry. (e) Replace any cracked or shorted cables. (f) Test and replace if necessary.* (g) Set gap.* (h) Refer to "Ignition Timing."* (i) Clean lines and system.** (j) Adjust float level—check seats.** (k) Adjust float level—check seats.** (l) Install new fuel pump.** (m) Measure float level. Adjust bowl vent.** Inspect operation of manifold heat control valve.
ENGINE STALLS OR ROUGH IDLE	(a) Idle speed set too low. (b) Incorrect choke adjustment. (c) Idle mixture too lean or too rich. (d) Incorrect carburetor float setting. (if equipped) (e) Leak in intake manifold. (f) Worn or burned distributor rotor. (g) Incorrect ignition wiring. (h) Faulty coil. (i) EGR valve leaking	(a) Adjust.** (b) Adjust.* (c) Adjust carburetor, if equipped.** (d) Adjust float setting.** (e) Inspect intake manifold gasket and replace if necessary.** (f) Install new rotor. (g) Install correct wiring. (h) Test and replace if necessary.* (i) Test and replace if necessary.#
ENGINE LOSS OF POWER	(a) Incorrect ignition timing. (b) Worn or burned distributor rotor. (c) Worn distributor shaft. (d) Dirty or incorrectly gapped spark plugs. (e) Dirt or water in fuel line, carburetor or filter. (f) Incorrect carburetor float setting. (if equipped) (g) Faulty fuel pump. (h) Incorrect valve timing. (i) Blown cylinder head gasket. (j) Low compression. (k) Burned, warped or pitted valves. (l) Plugged or restricted exhaust system. (m) Faulty ignition cables. (n) Faulty coil. (o) Amplifier defective.	(a) Refer to "Ignition Timing."* (b) Install new rotor. (c) Remove and repair distributor.* (d) Clean plugs and set gap.* (e) Clean lines, carburetor and replace.** (f) Adjust float level.** (g) Install new pump. (h) Refer to "Checking Valve Timing."*** (i) Install new head gasket.*** (j) Test compression of each cylinder.*** (k) Install new valves.*** (l) Install new parts as necessary. (m) Replace any cracked or shorted cables. (n) Test and replace as necessary.* (o) Test and replace as necessary.#
ENGINE MISSES ON ACCELERATION	(a) Dirty, or gap too wide in spark plugs. (b) Incorrect ignition timing. (c) Dirt in carburetor, if equipped. (d) Acceleration pump in carburetor, if equipped. (e) Burned, warped or pitted valves. (f) Faulty coil.	(a) Clean spark plugs and set gap.* (b) Refer to "Ignition Timing."* (c) Clean carburetor.** (d) Install new pump.** (e) Install new valves.*** (f) Test and replace if necessary.*
ENGINE MISSES AT HIGH SPEED	(a) Dirty or gap set too wide in spark plug. (b) Worn distributor shaft. (c) Worn or burned distributor rotor. (d) Faulty coil. (e) Incorrect ignition timing. (f) Dirty jets in carburetor, if equipped. (g) Dirt or water in fuel line, carburetor or filter.	(a) Clean spark plugs and set gap.* (b) Remove and repair distributor.* (c) Install new rotor. (d) Test and replace if necessary.* (e) Refer to "Ignition Timing."* (f) Clean jets.** (g) Clean lines, carburetor if equipped, and replace filter.**

Condition	Possible Cause	Correction
NOISY VALVES	(a) High or low oil level in crankcase. (b) Thin or diluted oil. (c) Low oil pressure. (d) Dirt in tappets. (e) Bent push rods. (f) Worn rocker arms. (g) Worn tappets. (h) Worn valve guides. (i) Excessive run-out of valve seats or valve faces.	(a) Check for correct oil level.*** (b) Change oil.*** (c) Check engine oil level. (d) Clean tappets.*** (e) Install new push rods.*** (f) Inspect oil supply to rockers.*** (g) Install new tappets.*** (h) Ream and install new valves with O/S Stems.*** (i) Grind valve seats and valves.***
CONNECTING ROD NOISE	(a) Insufficient oil supply. (b) Low oil pressure. (c) Thin or diluted oil. (d) Excessive bearing clearance. (e) Connecting rod journals out-of-round. (f) Misaligned connecting rods.	(a) Check engine oil level.*** (b) Check engine oil level. Inspect oil pump relief valve and spring.*** (c) Change oil to correct viscosity. (d) Measure bearings for correct clearance.*** (e) Replace crankshaft or regrind journals.*** (f) Replace bent connecting rods.***
MAIN BEARING NOISE	(a) Insufficient oil supply. (b) Low oil pressure. (c) Thin or diluted oil. (d) Excessive bearing clearance. (e) Excessive end play. (f) Crankshaft journal out-of-round worn. (g) Loose flywheel or torque converter.	(a) Check engine oil level.*** (b) Check engine oil level. Inspect oil pump relief valve and spring.*** (c) Change oil to correct viscosity. (d) Measure bearings for correct clearances.*** (e) Check No. 3 main bearing for wear on flanges.*** (f) Replace crankshaft or regrind journals. (g) Tighten to correct torque.
OIL PUMPING AT RINGS (SPARK PLUGS FOULING)	(a) Worn, scuffed, or broken rings. (b) Carbon in oil ring slot. (c) Rings fitted too tight in grooves. (d) Leaking intake gasket. (V-8 only) (e) Worn valve guides. (f) Leaking valve guide seals.	(a) Hone cylinder bores and install new rings.*** (b) Install new rings.*** (c) Remove the rings. Check grooves. If groove is not proper width, replace piston.*** (d) Replace gasket and torque to specifications. (e) Ream guides and replace valves with oversize. (f) Replace seals.
OIL PRESSURE DROP	(a) Low oil level. (b) Low oil pressure. (c) Clogged oil filter. (d) Worn parts in oil pump. (e) Thin or diluted oil. (f) Excessive bearing clearance. (g) Oil pump relief valve stuck. (h) Oil pump suction tube loose, bent or cracked.	(a) Check engine oil level. (b) See Checking Oil Pressure in STANDARD SERVICE PROCEDURES. Check sending unit. (c) Install new oil filter. (d) Replace worn parts or pump. (e) Change oil to correct viscosity. (f) Measure bearings for correct clearance.*** (g) Remove valve and inspect, clean, and reinstall. (h) Remove oil pan and install new tube if necessary.
OIL LEAKS	(a) Misaligned or deteriorated gaskets. Loose fastener, broken or porous metal part. See: "INSPECTION FOR ENGINE OIL LEAKS".	(a) Service Component***

*Refer to the "Electrical and Instruments" Group 8 for service procedures.

***Refer to the "Engine" Group 9 for service procedures.

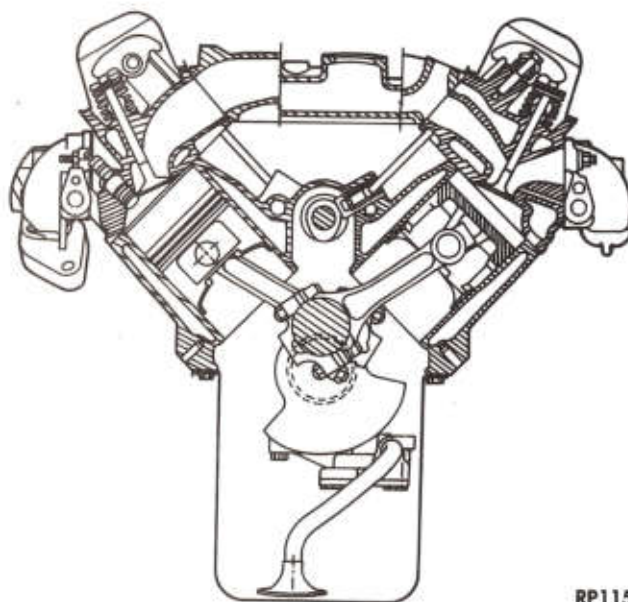
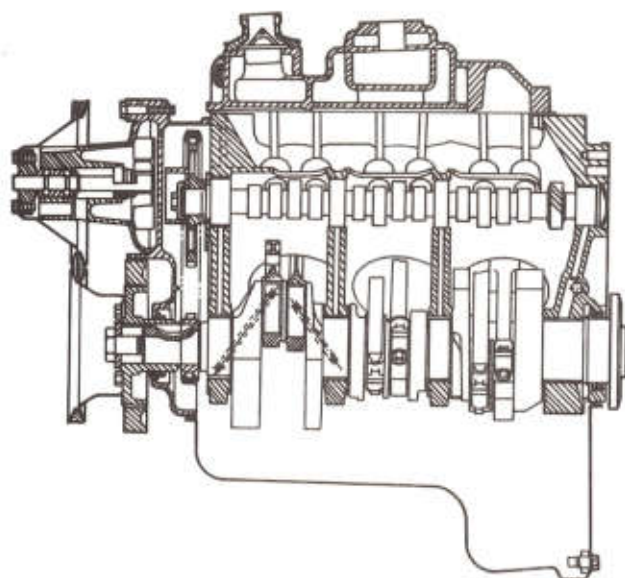
**Refer to the "Fuel System" Group 14 for service procedures.

#Refer to the "Emission Control Systems" Group 25 for service procedures.

3.9L V-6 ENGINE

INDEX

	Page		Page
3.9L Engine Information	7	Installing Piston and Connecting Rod Assembly	24
Camshaft	20	Intake Manifold (Sealing)	12
Camshaft Bearings	21	Measuring Connecting Rod Bearing Clearance ...	3
Connecting Rods	25	Measuring Main Bearing Clearance	3
Crankshaft Identification	25	Oil Filter	30
Crankshaft Main Bearings	25	Oil Line Plug	30
Crankshaft Main Journals	25	Oil Pan	28
Cylinder Block	23	Oil Pump	28
Cylinder Heads	11	Oversize and Undersize Engine Component Markings	35
Distributor Drive Shaft Bushing	22	Pistons, Pins, and Rings	23
Engine Core Oil and Cam Plugs	23	Rear Main Bearing Oil Seals	26
Engine Mounts (Front)	9	Repair of Damaged or Worn Threads	4
Engine Mounts (Rear)	10	Rocker Arms and Shaft Assembly	10
Engine Oiling System	27	Specifications	31
Engine Performance	1	Timing Chain Cover, Oil Seal and Chain	18
Engine Removal	9	Valve (Exhaust) Rotators	10
Form-In-Place Gasket/Sealing	1	Valves and Valve Springs	13
Honing Cylinder Bores	2		
Hydraulic Tappets	16		
Inspection for Engine Oil Leaks	4		



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Fig. 1—3.9L V-6 Engine

3.9L V-6 ENGINE INFORMATION

Type	90° V-6 Cylinder Engine	Engine Oil Capacity	4 Qts. (3.8 Liters) With or Without Oil Filter
Bore	3.91 Inch. (99.3mm)	Cooling System	Liquid Cooled-Forced Circulation Capacity—15.1 Qt.
Stroke	3.31 Inch (84.0mm)	Cylinder Block	Cast Iron
Compression Ratio	9.0:1	Crankshaft	Nodular Iron
Displacement	238 cu. in. (3.9L)	Cylinder Heads	Cast Iron
Torque	195 Lb. Ft. @ 2000 RPM	Connecting Rods	Forged Steel
Brake Horsepower	125 @ 4000 RPM	Pistons	Aluminum Alloy (w/Strut)
Firing Order	1-6-5-4-3-2		
Lubrication	Pressure Feed-Full Flow Filtration		

ENGINE: The 3.9L (238.5 cu. in.) displacement engine is a 90° "V" type six cylinder power plant with cast iron cylinder block and cylinder heads. Firing order for this engine is 1-6-5-4-3-2, and with split crankpins, offset by 22°, the firing intervals alternate between 128° and 112°. High turbulence cylinder heads allow a 9.0:1 compression ratio.

CRANKSHAFT: The nodular iron crankshaft is supported by four main bearings, with number two being the thrust bearing. Crankshaft "end" sealing is provided by front rubber seal and a rear "rope type" seal.

PISTONS: The pistons are cast aluminum (alloy-tin coated). Three rings are used. Piston pins, press fitted into place, join the pistons to forged steel connecting rods.

CAMSHAFT: The cast iron camshaft is mounted in four steel backed babbitt bearings. A thrust plate located in front of the first bearing, and bolted to the block, controls end play. A helical gear located rearward, between the twelfth cam lobe and rear bearing journal, operates the oil pump driveshaft and distributor. Dual timing chains drive the camshaft. These chains are enclosed by a cast aluminum cover which also carries a front crankshaft seal, provides front oil pan closure, water pump mounting, and is embossed with raised timing marks for strobe timing.

CYLINDER HEADS: Cylinder heads incorporate valve shrouding to create turbulence-producing combustion chambers, described as "fast burn". Valve guides and seats are integral and machined (and hardened, where required) with the cylinder head. A steel flanged composition "type" gasket is used between head and block.

VALVE COVERS: The valve covers are sealed with rubber-and-cork gaskets. Gasket compression is controlled by the use of stop-collared studs installed in the cylinder heads.

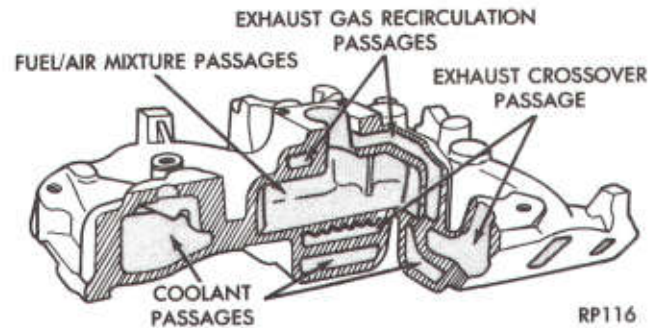


Fig. 2—Water Cooled Intake Manifold

INTAKE MANIFOLD: This intake manifold is a water cooled, aluminum casting (Fig. 2). Besides providing for single plane air/fuel induction, exhaust heat, and coolant (thermostat water box) crossover, the unit is also cored with passages routing "metered" coolant flow below the exhaust heat crossover, and full length of the manifold. This coolant flow, metered through "handed", right and left manifold side gaskets, plus the heat conductivity of aluminum provides uniform temperature control of all manifold functions, including sealing of steel embossed side gaskets and front and rear moulded gaskets.

The intake manifold is also cored with upper level EGR passages for balanced (cylinder to cylinder) EGR distribution.

VALVE TRAIN: Valve train design incorporates the use of hydraulic roller lifters and exhaust valve rotators. Rocker arms are "handed" right and left, and installed on a rocker arm shaft attached to the cylinder head with four bolts and retainers. Viton valve stem seals provide positive intake valve sealing. Cup shields are installed on exhaust valve stems. Conventional types of push rods, springs, retainers, and valve stem locks are used.

EXHAUST MANIFOLDS: Exhaust manifolds are "log" type with rear exits and attach directly to the cylinder heads. Both manifolds provide for air injection, while the right manifold incorporates a heat control valve.

SERVICE PROCEDURES

ENGINE REMOVAL (If Equipped with Manual Transmission See Group 21).

- (1) Scribe hood hinge outlines on hood and remove hood.
- (2) Drain cooling system and remove battery and carburetor air cleaner.
- (3) Remove radiator and heater hoses and remove radiator. Set fan shroud aside.
- (4) Discharge air conditioning, refer to Group 24 Air Conditioning for service procedures if so equipped.
- (5) Remove vacuum lines, distributor cap and wiring.
- (6) Remove throttle body, linkage, starter wires and oil pressure wire.
- (7) Remove air conditioning hoses and power steering hoses if so equipped.
- (8) Remove starter motor, alternator, charcoal canister and horns.
- (9) Disconnect exhaust pipe at manifold.
- (10) Remove bell housing bolts and inspection plate. Attach "C" clamp on front bottom of transmission torque converter housing to prevent torque converter from coming out.
- (11) Remove torque converter drive plate bolts from torque converter drive plate. Mark converter and drive plate to aid in reassembly.
- (12) Support transmission with a transmission stand tool number C-3201-A in its normal position relative to the vehicle. This will assure that the torque converter will remain in proper position in the transmission housing.
- (13) Disconnect the engine from the torque converter drive plate.
- (14) Install engine lifting fixture. Attach a chain hoist to fixture eyebolt.
- (15) Remove engine front mount bolts (Fig. 3).
- (16) Remove engine from engine compartment and install in engine repair stand.

Installation

- (1) Remove engine front repair stand and install in engine compartment.
- (2) Install torque converter drive plate bolts and front end mounts.
- (3) Install bell housing bolts. Remove "C" clamp and install inspection plate. Remove stand from transmission. See "ENGINE MOUNTS" for reassembly.
- (4) Remove engine lifting fixture and install throttle body and lines.
- (5) Install vacuum lines, distributor cap and wiring.
- (6) Install exhaust pipe.
- (7) Connect throttle body linkage and wiring to engine.

- (8) Install radiator, radiator hoses and heater hoses.
- (9) Install fan shroud in position. Fill cooling system full.
- (10) Install battery and throttle body air cleaner. Connect vacuum hose, power steering hoses, if so equipped.
- (11) Install air conditioning equipment and charge air conditioning. Refer to Group 24 Air Conditioning for service.
- (12) Warm engine and adjust.
- (13) Install hood and line up.
- (14) Road test vehicle.

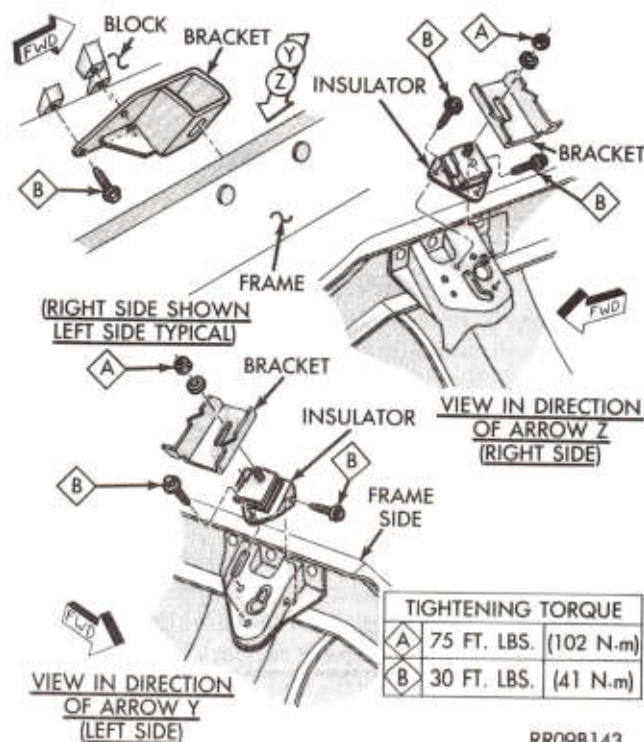
ENGINE FRONT MOUNTS (INSULATORS)

Removal

- (1) Raise hood and position fan to assure clearance for radiator top tank and hose.
- (2) Raise vehicle on hoist.
- (3) Install engine lifting fixture.
- (4) Remove screws & washers from bracket and insulator. (Fig. 3)
- (5) Raise engine with lifting fixture only far enough to remove insulators.

Installation

- (1) With engine raised slightly, position insulator



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Fig. 3—3.9L Front Engine Mounts

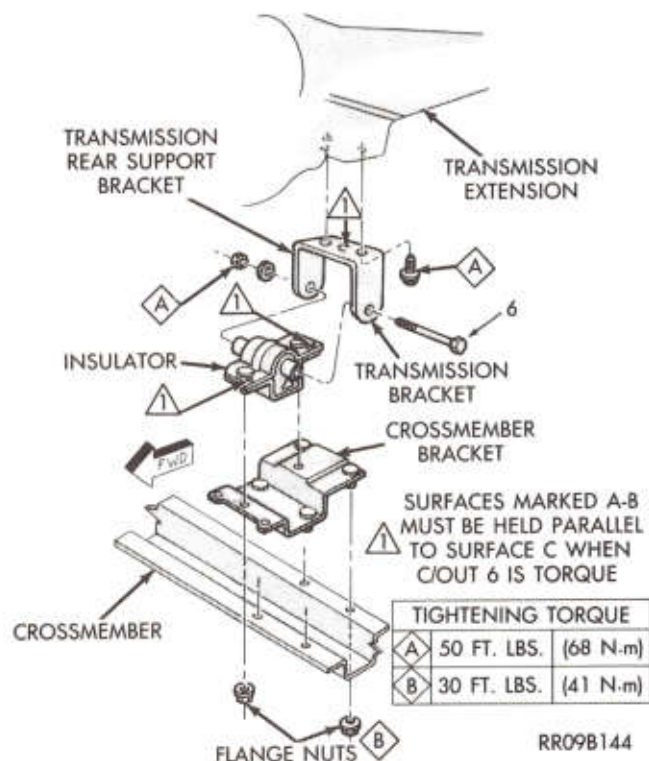


Fig. 4—Rear Engine (Mount) Insulator

on frame crossmember and install screw and washer assemblies (Fig. 3).

(2) Lower engine with lifting fixture while guiding insulator into bracket.

(3) Install insulator to bracket nut and washer. Tighten attaching nut to specified torque. (See Fig. 3).

(4) Remove lifting fixture.

ENGINE REAR MOUNT (INSULATOR)

Removal

(1) With vehicle on hoist, position transmission jack and raise rear of transmission and engine slightly.

(2) Remove rear mount (insulator) through-bolt. Remove screws attaching insulator to frame crossmember bracket (Fig. 4).

(3) Raise rear of transmission enough to provide insulator to crossmember clearance. Remove insulator.

Installation

(1) Install insulator in transmission extension housing bracket; install through bolt and with insulator secured in a "level" position (relative to final attachment to transmission rear support bracket) tighten through bolt to 50 foot pounds (68 N·m).

(2) Install insulator on frame crossmember bracket and tighten flange nuts to 30 foot pounds (41 N·m).

ENGINE ASSEMBLY

Checking Operation of EXHAUST VALVE ROTATORS

Before an engine is disassembled for valve grinding or major repair work, the performance of the exhaust valve rotators should be checked.

(1) With engine in vehicle, remove cylinder head covers.

(2) Observe exhaust valve rotation with the engine running at 2000 and 3000 rpm the valve should rotate at uniform and constant speeds, (direction of rotation is not important). There is generally a large difference in rotation speeds between 1000 and 3000 rpm.

(3) Rotators which do not appear to rotate should be replaced.

ROCKER ARMS AND SHAFT ASSEMBLY

Removal

(1) Disconnect spark plug wires by pulling on the boot straight out in line with plug.

(2) Disconnect closed ventilation system and evaporation control system from cylinder head cover.

(3) Remove cylinder head cover and gasket.

(4) Remove four rocker shaft bolts and retainers.

(5) Remove rocker arms and shaft assembly.

(6) If rocker arm assemblies are disassembled for cleaning or replacement, refer to (Fig. 5) for rocker arm identification, and (Fig. 6) for positioning on the shaft.

(7) On engines with exhaust valve rotators, exhaust rocker arm must have relief for clearance. Refer to (Fig. 5).

Installation

(1) Install rocker arm and shaft assemblies with "Notch" (Fig. 9) on end of rocker shaft pointing to center line of engine and toward front of engine on the left bank and to the rear on right bank, making sure to install the long stamped steel retainers in the number two and four positions, tighten to 200 in. lb. (23 N·m) (Fig. 9).

WARNING: THE ROCKER ARM SHAFT SHOULD BE TORQUED DOWN SLOWLY, STARTING WITH THE CENTERMOST BOLTS. ALLOW 20 MINUTES TAPPET BLEED DOWN TIME AFTER INSTALLATION OF THE ROCKER SHAFTS BEFORE ENGINE OPERATION.

(2) Clean cylinder head cover gasket surface.

Inspect cover for distortion and straighten if necessary.

(3) Clean head rail if necessary. Install cylinder head cover and tighten to 80 in. lb. (9 N·m).

(4) Install closed crankcase ventilation system and evaporation control system.

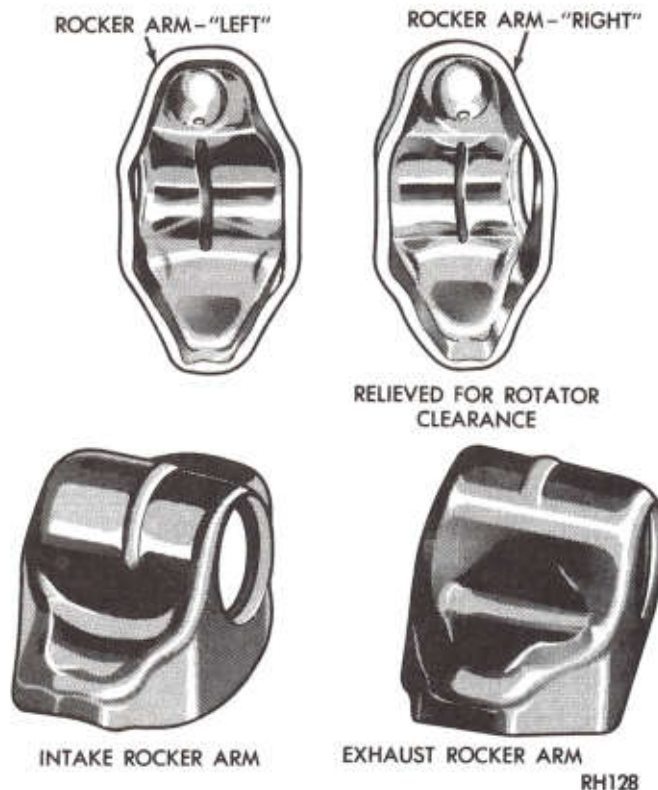


Fig. 5—Intake and Exhaust Rocker Arm Identification

CYLINDER HEADS

The alloy cast iron cylinder heads shown in (Fig. 7) are held in place by 8 bolts. The spark plugs are located in peak of the wedge between the valves.

Removal

- (1) Drain cooling system and disconnect battery ground cable.
- (2) Remove alternator, carburetor air cleaner and fuel line.
- (3) Disconnect accelerator linkage.
- (4) Remove distributor cap and wires.

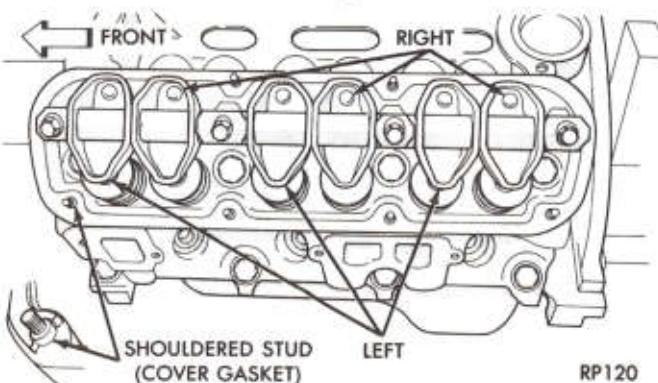


Fig. 6—Rocker Arm Location—Left Bank

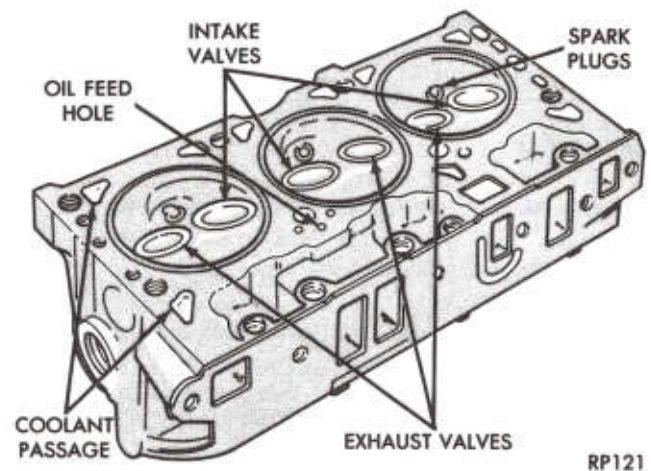


Fig. 7—Cylinder Head Assembly

- (5) Disconnect coil wires, heat indicator sending unit wire, heater hose and by-pass hose.
- (6) Remove closed ventilation system, evaporation control system and cylinder head covers.
- (7) Remove intake manifold, and throttle body as an assembly.
- (8) Remove exhaust manifolds.
- (9) Remove rocker arm and shaft assemblies. Remove push rods and **identify to insure installation in original locations.**
- (10) Remove the 8 head bolts from each cylinder head and remove cylinder heads.
- (11) Place cylinder heads in holding fixture Tool C-3626. Remove spark plugs.

Installation

- (1) Clean all surfaces of cylinder block and cylinder heads.
- (2) Inspect all surfaces with a straightedge if there is any reason to suspect leakage. If out of flatness exceeds .00075 inch times the span length in inches in any direction, either replace head or lightly machine the head surface. As an example, if a 12 inch span is .004 inch out of flat, allowable is $12 \times .00075$ equals .009 inch. This amount of out of flat is acceptable.

The cylinder head surface finish should be 70-180 micro-inches.

- (3) Install new gaskets on cylinder block.
- (4) Remove cylinder heads from holding fixtures and place heads on engine.
- (5) On 6 cylinder engines bolt thread sealer is not required. Starting at top center, tighten all cylinder head bolts to 50 ft. lbs. (68 N-m) in sequence shown in Figure 8. Repeat procedure, retighten all cylinder head bolts to 105 ft. lbs. (143 N-m).
- (6) Inspect push rods and replace worn or bent rods.
- (7) Install push rods, rocker arm and shaft assemblies with the "NOTCH" on the end of rocker-shaft pointing to center line of engine and toward front of

engine on the left bank and to the rear on right bank (notch always to left as facing cylinder head), making sure to install the long stamped steel retainers in the number two and four positions, tighten to 200 in. lb. (23 N-m) (Fig. 9).

Intake Manifold (Water Cooled) Sealing

"Right" and "Left" side gaskets are required. These steel embossed gaskets, while providing conventional sealing also provide metered coolant flow. Cutouts at top front of each gasket (LT for left side and RT for right side) identifies each gasket position (Fig. 10).

(8) Coat intake manifold side gaskets lightly with sealer. Part Number 4318035, or equivalent.

(9) Install side gaskets to cylinder head.

(10) Clean cylinder block front and rear gasket surfaces using a suitable solvent (Fig. 11).

(11) Apply a thin, uniform coating of a quick dry cement to the intake manifold front and rear gaskets and cylinder block gasket surface.

When installing gaskets, the center hole in the gasket MUST engage dowels in block. End holes in seals MUST be locked into tangs of head gasket. (Fig. 11).

(12) Carefully install the front and rear intake manifold gaskets.

(13) Place a drop (approximately 1/4" diameter) of rubber sealer Part Number 4318025 or equivalent, onto each of the **four** manifold to cylinder head gasket corners.

(14) Carefully lower intake manifold into position on the cylinder block and cylinder heads. After intake manifold is in place, **inspect to make sure seals are in place.**

(15) Install the twelve attaching cap screw "Finger Tight." Tighten cap screws one through four to 25 ft. lb. (34 N-m) and tighten remaining cap screws to 25 ft. lb. (34 N-m) in the tightening sequence shown in (Fig. 12) then retighten cap screws one through four to 50

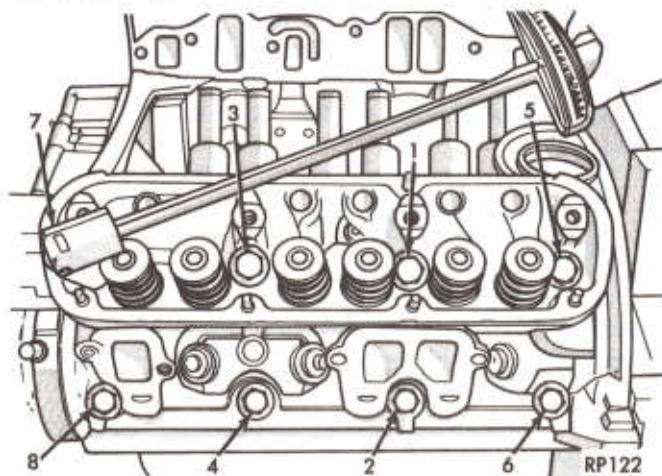


Fig. 8—Cylinder Head Bolt Tightening Sequence

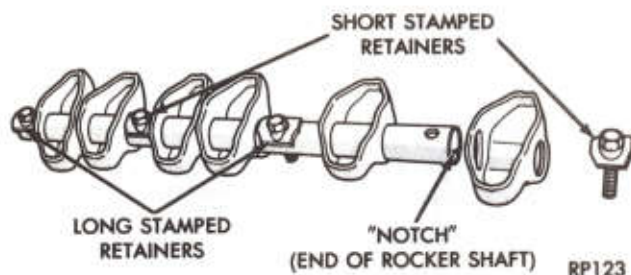


Fig. 9—Rocker Arm Retainers and "Notch" Location

ft. lb. (54 N-m) and follow by retightening the remaining cap screws to 40 ft. lb. (54 N-m) in sequence shown. (Fig. 12).

(16) Install exhaust manifolds and tighten bolts to 20 ft. lbs. (27 N-m) and nuts to 15 ft. lbs. (20 N-m).

(17) Adjust spark plugs to specifications in Electrical Section, "Group 8" and install the plugs.

(18) Install coil wires, heat indicator sending unit wire, heater hoses and by-pass hose.

(19) Install throttle linkage and adjust as necessary.

(20) Install distributor cap and wires.

(21) Install fuel lines, alternator and drive belt. Tighten alternator mounting bolt to 30 ft. lbs. (41 N-m) and adjusting strap bolt to 200 in. lb. (23 N-m). See Cooling Section on adjusting belt tension.

(22) Install collared studs in cylinder head. Tighten to 115 in. lbs. (13 N-m). Inspect studs to be certain that collar has bottomed on cylinder head. If not, remove stud and clean and retap stud hole.

(23) Place new cylinder head cover gaskets in position and install cylinder head covers. Tighten to 80 in. lb. (9 N-m).

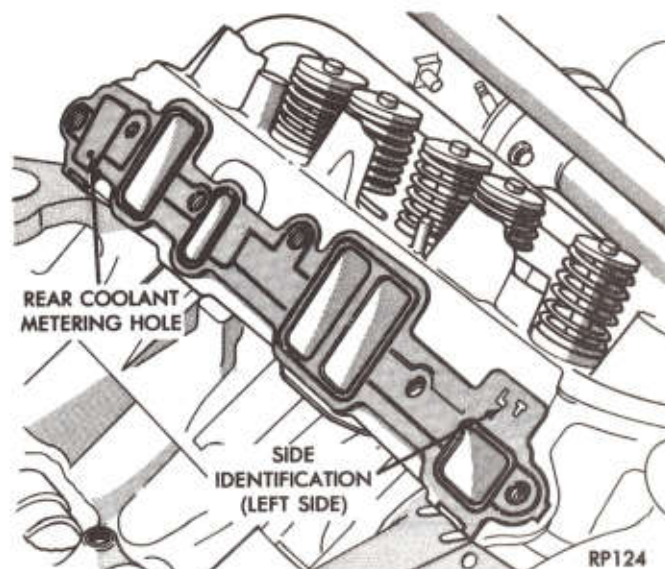


Fig. 10—Intake Manifold Side Gaskets—Left Side Shown

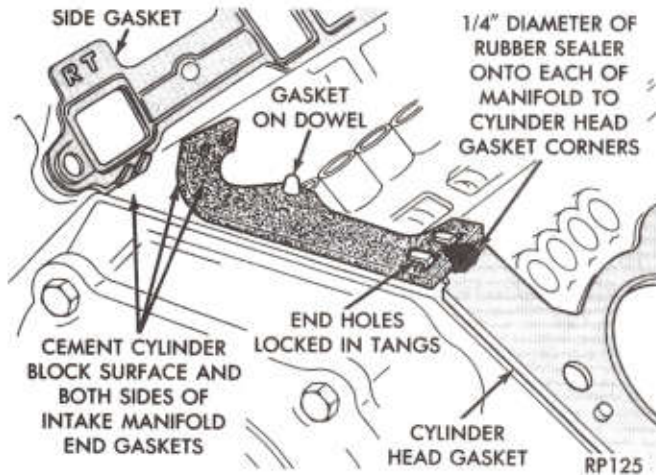


Fig. 11—Intake Manifold Sealing

(24) Install closed crankcase ventilation system and evaporation control system.

(25) Fill cooling system and install battery ground cable.

VALVES AND VALVE SPRINGS

The valves are arranged in line in the cylinder heads and inclined 18 degrees. The rocker shaft support and the valve guides are cast integral with the heads.

Removal

(1) With cylinder head removed, compress valve springs using Tool C-3422-A, as shown in (Fig. 13).

(2) Remove valve retaining locks, valve spring retainers, valve stem cup seals and valve springs.

(3) Before removing valves, **remove any burrs from**

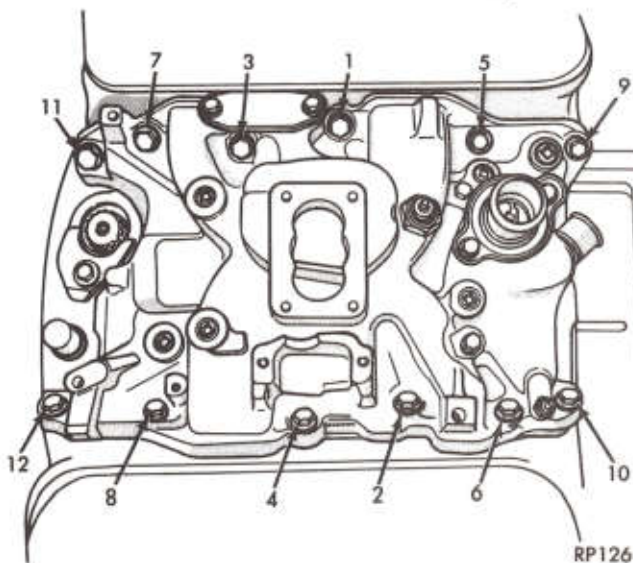


Fig. 12—Intake Manifold Screw Tightening Sequence

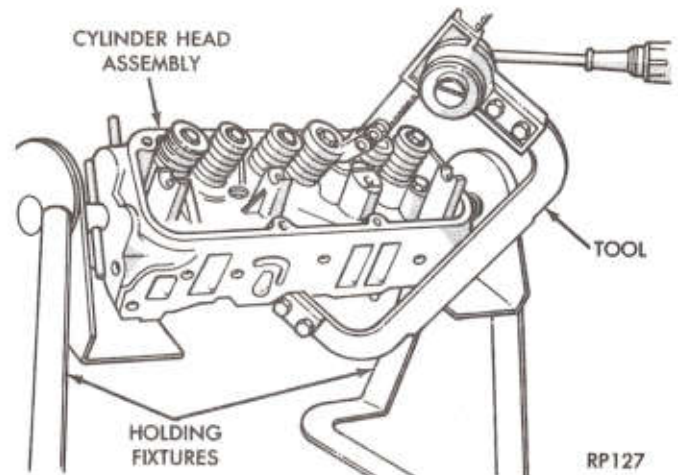


Fig. 13—Compress Valve Springs with Tool C-3422A

valve stem lock grooves to prevent damage to the valve guides. Identify valves to insure installation in original location.

Valve Inspection

(1) Clean valves thoroughly and discard burned, warped and cracked valves.

(2) Measure valve stems for wear. New stem diameters should measure:

Intake372 to .373 inch (9.449 to 9.474mm)

Exhaust371 to .372 inch (9.423 to 9.449mm)

If wear exceeds .002 inch, replace valve.

(3) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(4) Measure valve stem guide clearance as follows:
(a) Install sleeve Tool C-3973 over valve stem (Fig. 14) and install valve. The special sleeve places the valve at the correct height for checking with a dial indicator.

(b) Attach dial indicator Tool C-3339 to cylinder head and set it at right angle of valve stem being measured (Fig. 15).

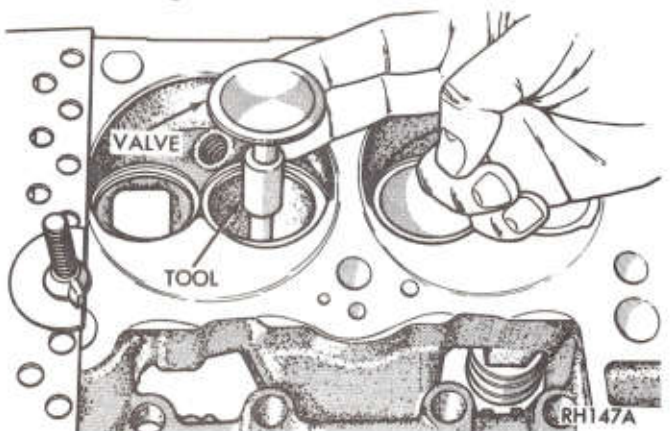


Fig. 14—Positioning Valve with Tool C-3973

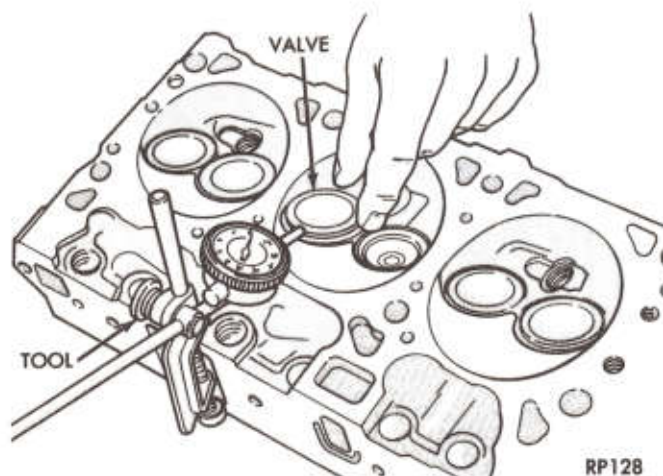


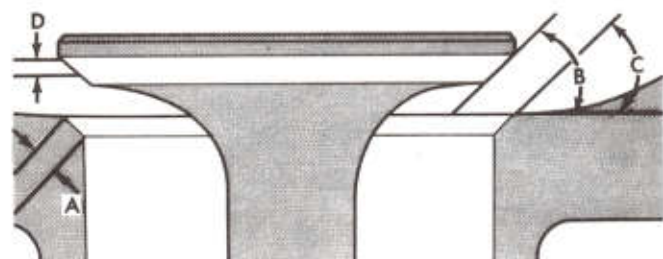
Fig. 15—Measuring Valve Guide Wear

(c) Move valve to and from the indicator. The total dial indicator reading should not exceed .017 (.432mm) inch. Ream the guides for valves with over-size stems if dial indicator reading is excessive or if the stems are scuffed or scored.

(5) Service valves with oversize stems are available in .005 (.127mm), .015 (.381mm) and .030 (.762mm) inch oversize. Reamers to accommodate the oversize valve stem are as follows:

Reamer Tool Number	Reamer Oversize	Valve Guide Size
C-3433	.005 in.	.379-.380 in.
C-3430	.015 in.	.389-.390 in.
C-3427	.030 in.	.404-.405 in.

(6) Slowly turn reamer by hand and clean guide thoroughly before installing new valve. **Do not attempt to ream the valve guides from standard directly to .030 inch. Use step procedure of .005, .015 and .030 inch so the valve guides may be reamed true in relation to the valve seat.**



A-SEAT WIDTH (INTAKE 1/16 (1.587 mm) TO 3/32 (2.381 mm) INCH
EXHAUST: (.080-.100 INCH) - (2-2.5 mm)

B-FACE ANGLE (INTAKE & EXHAUST: 44½°-45°)

C-SEAT ANGLE (INTAKE & EXHAUST: 45°-45½°)

D-CONTACT SURFACE

PU605

Fig. 16—Valve Face and Seat Angles

Refacing Valves and Valve Seats

The intake and exhaust valves have a 44-1/2-45 degree face angle. The valve seats have a 45-45-1/2 degree face angle. The valve face and valve seat angles are shown in (Fig. 16).

Valves

Inspect the remaining margin after the valves are refaced (Fig. 17). Valves with less than 3/64 (1.190mm) margin should be discarded.

Valve Seats

CAUTION: Do not un-shroud valves during valve seat refacing (Fig. 18).

(1) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

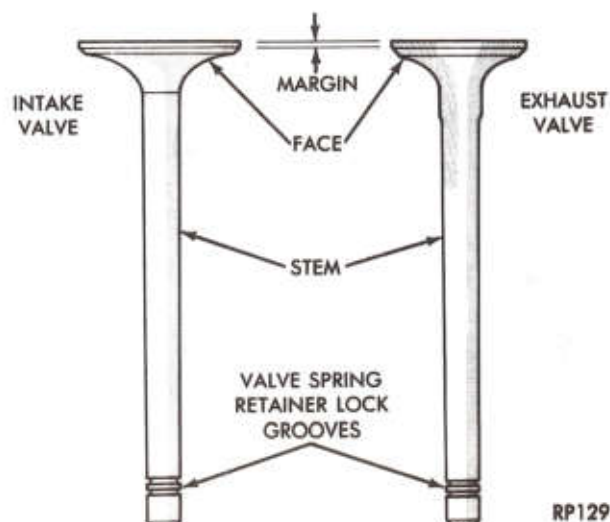
(2) Measure the concentricity of valve seat using dial indicator No. 13725. Total runout should not exceed .002 (.051mm) (total indicator reading).

(3) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to the top edge of valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to bottom edge of valve face raise valve seat with a 60 degrees stone.

(4) When seat is properly positioned the width of intake seats should be 1/16 to 3/32 inch (1.587 to 2.381mm). The width of the exhaust seats should be .080-.100 inch (2-2.5mm).

Testing Valve Springs (Fig. 19)

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs



RP129

Fig. 17—Intake and Exhaust Valves

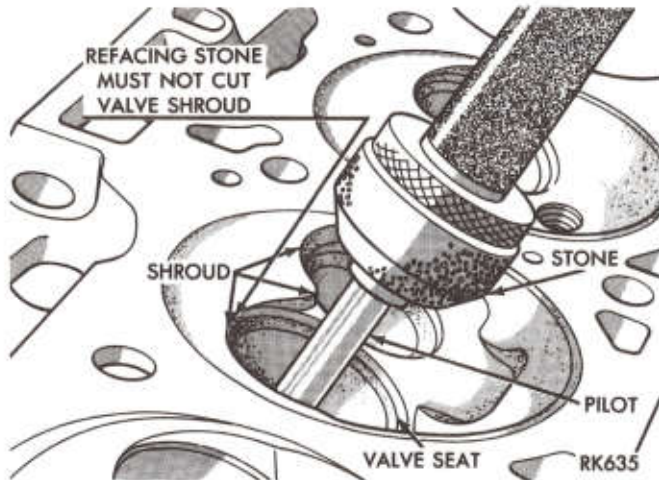


Fig. 18—Refacing Valve Seats

should be tested. As an example the compression length of the spring to be tested is 1-5/16 inches. Turn table of Tool C-647 until surface is in line with the 1-5/16 inch mark on the threaded stud and the zero mark to the front. Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to specifications to obtain specified height and allowable tensions. Discard the springs that do not meet specifications.

(2) Inspect each valve spring for squareness with a steel square and surface plate, test springs from both ends (Fig. 20).

If the spring is more than 5/64 inch (1.984mm) out of square, install a new spring.

Installation

Installing the wrong exhaust valve spring in en-

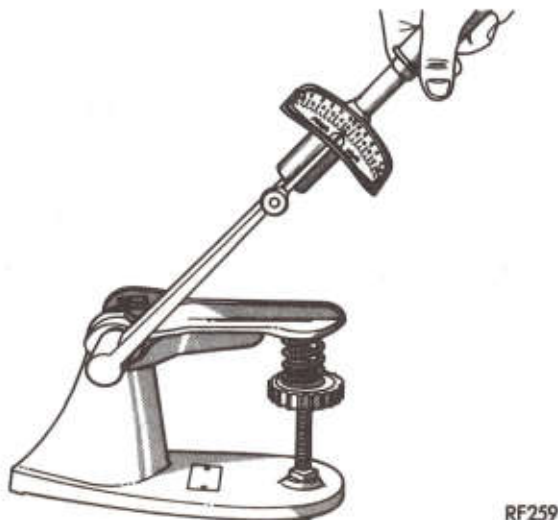


Fig. 19—Testing Valve Spring for Compressed Length with Tool C-647

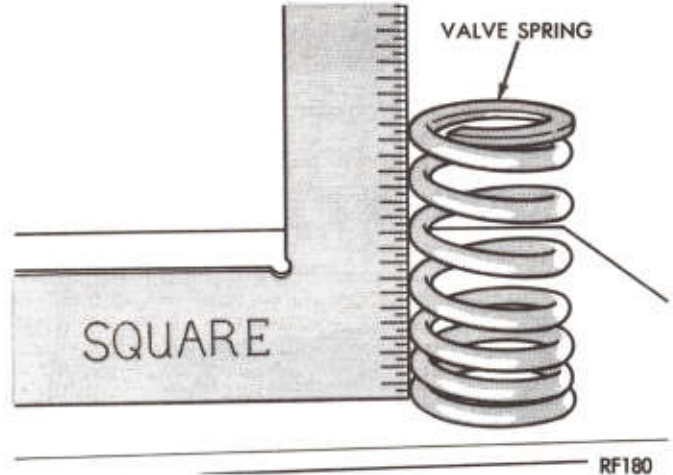


Fig. 20—Checking Valve Spring for Squareness

gines with positive rotators can cause severe engine damage. Refer to specifications for proper identification.

(1) Coat valve stems with lubrication oil and insert them in cylinder head.

(2) If valves or seats are reground, check valve stem height with Tool C-3968 (Fig. 21). If valve is too long grind off the tip until length is within limits.

Engine is equipped with exhaust valve rotators, do not grind exhaust valve stem tips.

(3) Install new cup seals on all valve stems and over valve guides (Fig. 22). Install valve springs and valve retainers.

(4) Compress valve springs with Tool C-3422-A, install locks and release tool. If valves and/or seats are reground, measure the installed height of springs, make sure measurement is taken from bottom of spring seat in cylinder head to the bottom surface of spring retainer (if spacers are installed, measure from the top of spacer). If height is greater than 1-11/16 inches, (42.86mm), install a 1/16 inch (1.587mm) spacer in head counterbore to bring

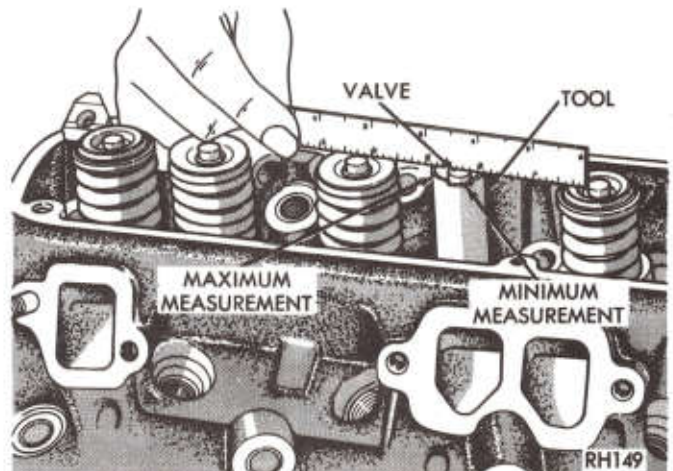


Fig. 21—Measuring Valve Stem Length with Tool C-396B

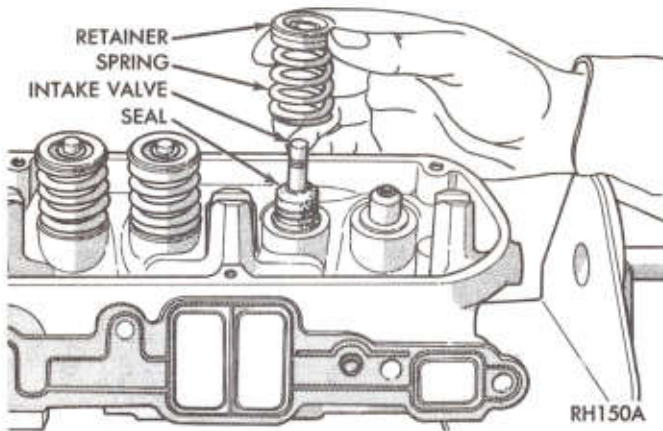


Fig. 22—Installing Valve, Cup Seal, Spring and Retainer

spring height back to normal 1-5/8 to 1-11/16 inch (41.27 to 42.86mm). Exhaust valve springs with positive rotators should have a length of 1.45-1.51 inch (36.8-38.1mm) when the valve is closed.

Replace, Valve Stem Shields or Valve Springs, Cylinder Head Not Removed

(1) Set engine basic timing to TDC and remove Air Cleaner.

(2) Remove cylinder head covers and spark plugs.

(3) Remove coil wire from distributor and secure to good ground to prevent engine from starting.

(4) Using suitable socket and flex handle at crankshaft pulley retaining screw, turn engine so the number 1 piston is at Top Dead Center on the compression stroke.

(5) Remove rocker arms with rocker shaft and install a dummy shaft. (The rocker arms should not be disturbed and left on shaft).

(6) With air hose attached to adapter Tool C-3907 installed in number 1 spark plug hole, apply 90 to 100 psi air pressure (620.5 to 689 kPa).

(7) Using Tool C-3906 or C-4228 compress valve spring and remove retainer valve locks and valve spring.

(8) Install cup shields on the exhaust valve stem and position down against valve guides.

(9) The intake valve stem seals should be pushed firmly and squarely over the valve guide using the valve stem as a guide. **Do Not Force** seal against top of guide. When installing the valve retainer locks, compress the spring **only enough** to install the locks.

(10) Follow the same procedure on the remaining 5 cylinders using the firing sequence 1-6-5-4-3-2. **Make sure piston in cylinder is at TDC on the valve spring that is being removed.**

(11) Remove adapter Tool 3907.

(12) Remove dummy shaft and install rocker shaft with rocker arms.

(13) Install covers and coil wire to distributor.

(14) Install air cleaner.

(15) Road test vehicle.

HYDRAULIC TAPPETS

Valve train modifications include roller tappet assemblies, aligning yokes and yoke retainers.

Roller tappet alignment is maintained by machined flats on tappet body being fitted (in pairs) into six aligning yokes. The yokes are secured by an alignment yoke retainer (Fig. 23).

Preliminary to Check the Hydraulic Tappets

Before disassembling any part of the engine to correct tappet noise, read the oil pressure at the gauge (install a reliable gauge at pressure sending unit if vehicle has no oil pressure gauge) and check the oil level in the oil pan. The pressure should be between 30 and 80 pounds (207 to 552 kPa) at 2000 RPM.

The oil level in the pan should never be above the "full" mark on dipstick, or below the "add oil" mark. Either of these two conditions could be responsible for noisy tappets. **Oil Level Check:** stop engine after reaching normal operating temperature. Allow 5 minutes to stabilize oil level, check dipstick.

Oil Level Too High

If oil level is above the "full" mark on dipstick, it is possible for the connecting rods to dip into the oil while engine is running and create foam. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to lose length and allow valves to seat noisily.

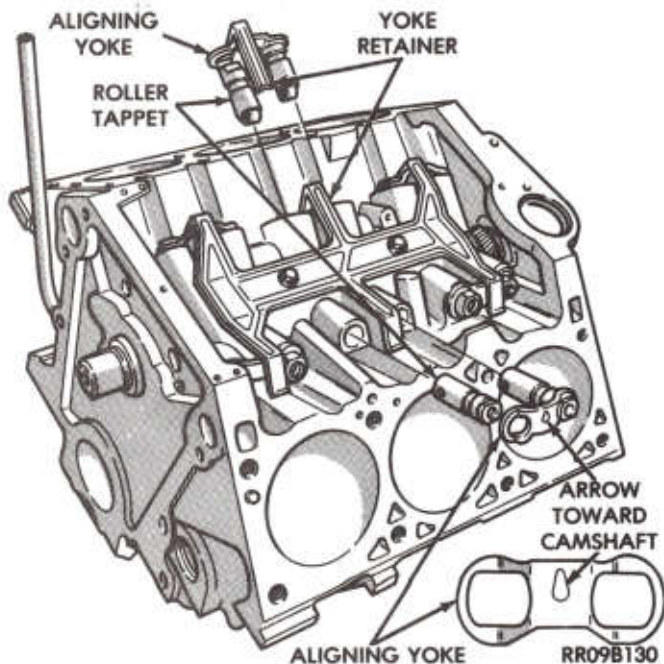


Fig. 23—Roller Tappets Aligning Yoke and Retainer

Oil Level Too Low

Low oil level may allow oil pump to take in air which when fed to the tappets, causes them to lose length and allows valves to seat noisily. Any leaks on intake side of oil pump through which air can be drawn will create the same tappet action. Check the lubrication system from the intake strainer to the pump cover, including the relief valve retainer cap. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than one tappet will be noisy. When oil level and leaks have been corrected, engine should be operated at fast idle for sufficient time to allow all of the air inside of the tappets to be bled out.

Tappet Noise Diagnosis

(1) To determine source of tappet noise, operate engine at idle with cylinder head covers removed.

(2) Feel each valve spring or rocker arm to detect noisy tappet. The noisy tappet will cause the affected spring and/or rocker arm to vibrate or feed rough in operation.

Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

(3) Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leakdown around the unit plunger which will necessitate replacing the tappet, or by the plunger partially sticking in the tappet body cylinder. A heavy click is caused either by a tappet check valve not seating, or by foreign particles becoming wedged between the plunger and the tappet body, causing the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed for inspection and cleaning.

Tappet Removal

(1) Remove valve cover and rocker assembly and push rods and identify push rods to insure installation in original location.

(2) With roller tappets, remove intake manifold, yoke retainer and aligning yokes (Fig. 23).

(3) Slide Tool C-4129 through opening in cylinder head and seat tool firmly in the head of tappet.

(4) Pull tappet out of bore with a twisting motion. If all tappets are to be removed, **identify tappets to insure installation in original location.**

If the tappet or bore in cylinder block is scored, scuffed, or shows signs of sticking, ream the bore to next oversize and replace with oversize tappet.

CAUTION: The plunger and tappet bodies are not interchangeable. The plunger and valve must always be fitted to the original body. It is advisable to work on one tappet at a time to avoid mixing of parts. Mixed parts are not compatible. Do not disassemble a tappet on a dirty work bench.

Disassembly (Fig. 24)

- (1) Pry out plunger retainer spring clip.
- (2) Clean varnish deposits from inside of tappet body above plunger cap.
- (3) Invert tappet body and remove plunger cap, plunger, check valve, check valve spring, check valve retainer and plunger spring. Check valve could be flat or ball.

Cleaning and Assembly

- (1) Clean all tappet parts in a solvent that will remove all varnish and carbon.
- (2) Replace tappets that are unfit for further service with new assemblies.
- (3) If plunger shows signs of scoring or wear and valve is pitted, or if valve seat on end of plunger indicates any condition that would prevent valve from seating, install a new tappet assembly.
- (4) Assemble tappets (Fig. 24).

Installation

- (1) Lubricate tappets.
- (2) Install tappets in their original positions.
- (3) With roller tappets, install aligning yokes with "arrow" toward camshaft (Fig. 23).
- (4) With roller tappets, install yoke retainer and torque screws to 200 in. lbs. (23 N-m) (Fig. 23) and install intake manifold.
- (5) Install push rods in original positions.
- (6) Install rocker arm and shaft assembly.
- (7) Install valve cover.
- (8) Start and operate engine. Warm up to normal operating temperature.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic tappets have filled with oil and have become quiet.

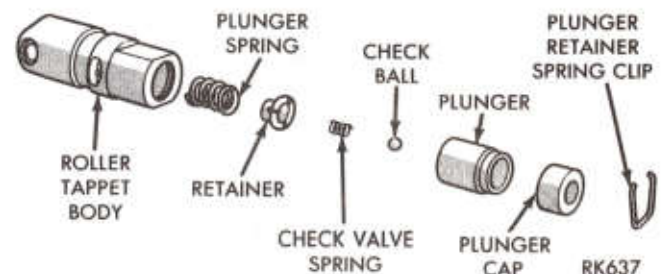


Fig. 24—Hydraulic Roller Tappet Assembly

VALVE TIMING

(1) Turn crankshaft until the No. 6 exhaust valve is closing and No. 6 intake valve is opening.

(2) Insert a 1/4 inch (6.350mm) spacer between rocker arm pad and stem tip of No. 1 intake valve. Allow spring load to bleed tappet down giving in effect a solid tappet.

(3) Install a dial indicator so plunger contacts valve spring retainer as nearly perpendicular as possible. Zero the indicator.

(4) Rotate the crankshaft clockwise (normal running direction) until the valve has lifted .010 inch (.254mm).

CAUTION: Do not turn crankshaft any further clockwise as valve spring might bottom and result in serious damage.

The timing of the crankshaft pulley should now read from 10 degrees before top dead center to 2 degrees after top dead center. Remove spacer.

(5) If reading is not within specified limits:

- (a) Check sprocket index marks.
- (b) Inspect timing chain for wear.

(c) Check accuracy of DC mark on timing indicator.

TIMING CHAIN COVER, OIL SEAL AND CHAIN

Cover Removal

- (1) Drain cooling system.
- (2) Refer to Cooling System Group 7 for procedure to remove water pump.
- (3) Remove power steering pump.
- (4) Remove pulley from vibration damper and bolt washer securing vibration damper on crankshaft.
- (5) Install bar from Tool (C-3688) and screw from Tool (C-3732A) and pull vibration damper from end of crankshaft (Fig. 25).
- (6) Remove fuel lines and fuel pump.
- (7) Loosen oil pan bolts and remove the front bolt at each side.
- (8) Remove chain case cover and gasket using extreme caution to avoid damaging oil pan gasket.

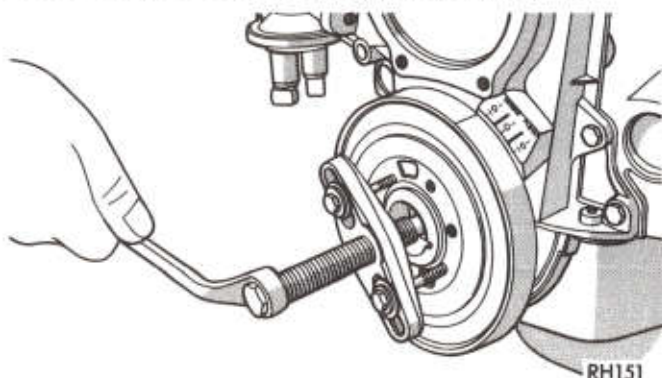


Fig. 25—Removing Vibration Damper Assembly

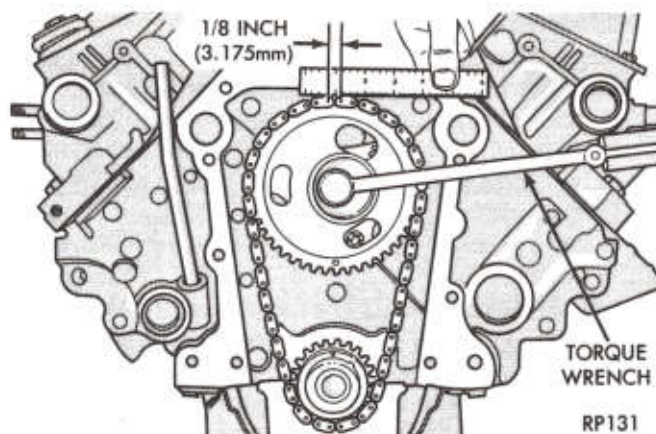


Fig. 26—Measuring Timing Chain Wear and Stretch

Measuring Timing Chain for Stretch

(1) Place a scale next to timing chain so that any movement of chain may be measured.

(2) Place a torque wrench and socket over camshaft sprocket attaching bolt and apply torque in direction of crankshaft rotation to take up slack; 30 ft. lb. (41 N·m) (with cylinder head installed) or 15 ft. lb. (20 N·m) (cylinder heads removed). **With a torque applied to the camshaft sprocket bolt, crankshaft should not be permitted to move. It may be necessary to block crankshaft to prevent rotation.**

(3) Holding a scale with dimensional reading even with edge of a chain link, apply torque in the reverse direction 30 ft. lb. (41 N·m) (with cylinder heads installed) or 15 ft. lb. (20 N·m) (cylinder heads removed) and note amount of chain movement (Fig. 26).

(4) Install a new timing chain, if its movement exceeds 1/8 (3.175mm) inch.

(5) If chain is not satisfactory, remove camshaft sprocket attaching cup washer, fuel pump eccentric and remove timing chain with crankshaft and camshaft sprockets.

(6) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(7) Place timing chain around both sprockets.

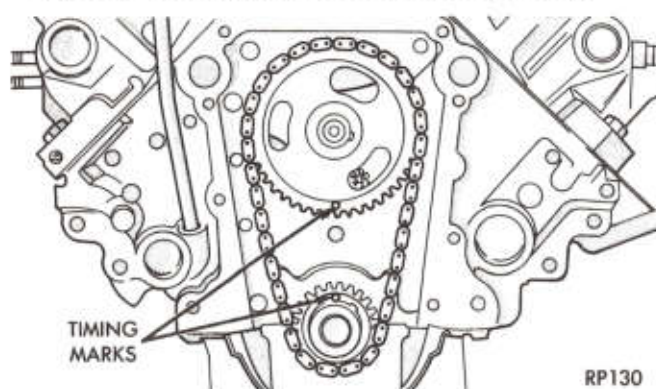


Fig. 27—Alignment of Timing Marks

(8) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

(9) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(10) Slide both sprockets evenly over their respective shafts and use a straight edge to check alignment of timing marks (Fig. 27).

(11) Install the fuel pump eccentric, cup washer, and camshaft bolt. Tighten bolt to 35 foot pounds (47 N·m).

(12) Check camshaft for .002 for .006 inch (.051 to .0152mm) end play with a new thrust plate and up to .010 inch (.254mm) end play with a used thrust plate. If not within these limits install a new thrust plate.

TIMING CHAIN COVER EXTERNAL OIL SEAL

Removal

- (1) Disconnect battery.
- (2) Loosen and remove belts from crankshaft pulley.
- (3) Remove radiator shroud retainer screws and set shroud back over engine.
- (4) Remove fan and shroud from engine.
- (5) Remove crankshaft pulley and vibration damper bolt and washer from end of crankshaft.
- (6) Install bar from Tool (C-3688) and screw from Tool (C-3732A) and pull vibration damper from end of crankshaft. (Fig. 25).
- (7) Using a suitable tool behind the lips of the oil seal pry outward, being careful not to damage the crankshaft seal surface of cover. (Fig. 28).

Installation

- (1) Install new seal by installing the threaded shaft part of tool (C-4251) into the threads of the crankshaft.
- (2) Place seal into opening with seal spring towards the inside of the engine.
- (3) Place the installing adapter C-4251-3 with the thrust bearing and nut on the shaft. Tighten nut until tool is flush with the timing chain cover. (Fig. 29).

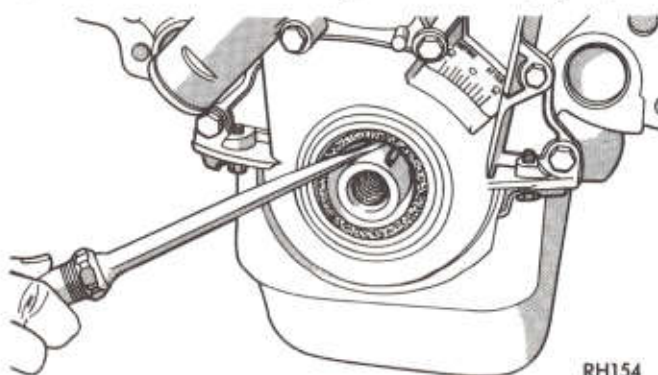


Fig. 28—Removing Oil Seal

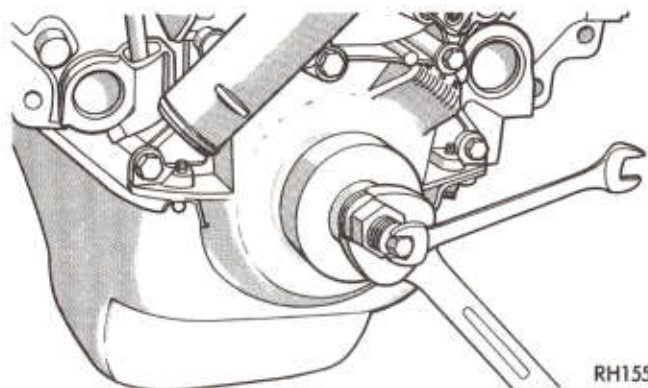


Fig. 29—Installing Oil Seal

- (4) Install vibration damper using Tool C-3688 (Fig. 30).
- (5) Install retainer bolt and washer and torque to 135 ft. lb. (183 N·m).
- (6) Install pulley on vibration damper and torque to 200 in. lb. (23 N·m).
- (7) Set radiator shroud back over engine and install fan belts.
- (8) Install radiator shroud to radiator.
- (9) Connect battery.

Cover Installation

- (1) Be sure mating surfaces of chain case cover and cylinder block are clean and free from burrs.
- (2) Using a new cover gasket, carefully install chain case cover to avoid damaging oil pan gasket. A 1/8 (3.175mm) inch diameter bead of RTV sealer (PN-4026070) or equivalent is recommended on the oil pan gasket. **Do not tighten screws at this time.**
- (3) Lubricate seal lip with lubriplate or equivalent. Position damper hub slot in crankshaft. Damper will act as a pilot for the crankshaft seal.
- (4) Place installing tool, part of Puller set Tool C-3688 in position and press vibration damper on crankshaft (Fig. 30).
- (5) Tighten chain case cover cap screws to 30 ft. lbs. (41 N·m) **first**. Then tighten oil pan cap screws to 200 in. lbs. (23 N·m).

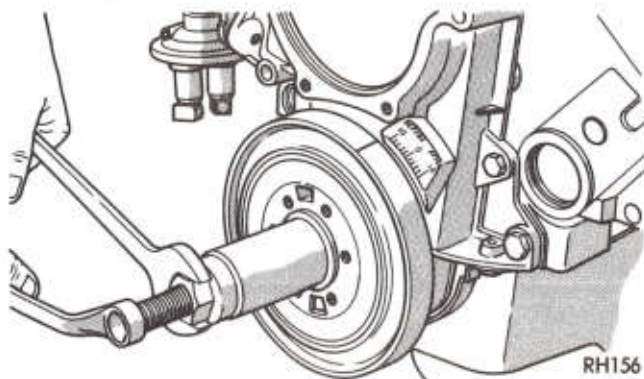


Fig. 30—Installing Vibration Damper with Tool C-3688

(6) Install vibration damper retainer bolt with washer and tighten to 135 ft. lb. (183 N·m).

(7) Position pulley on vibration damper and attach with bolts and lockwashers. Tighten to 200 in. lb. (23 N·m).

(8) Install fuel lines.

(9) Install water pump and housing assembly using new gaskets. Tighten bolts to 30 ft. lb. (41 N·m).

(10) Install power steering pump.

(11) Install fan and belt, hoses and close drains.

(12) Install radiator shroud.

(13) Fill cooling system.

CAMSHAFT

(Engine Removed from Vehicle)

The camshaft has an integral oil pump and distributor drive gear, as shown in (Fig. 32). Remove intake manifold, cylinder head covers, timing case cover and timing chain.

(1) Remove rocker arm and shaft assemblies.

(2) Remove push rods and tappets; identify so each part will be replaced in its original location.

(3) Remove distributor and lift out the oil pump and distributor drive shaft.

(4) Remove camshaft thrust plate, **note location of oil tab (Fig. 34).**

(5) Install a long bolt into front of camshaft to facilitate removal of the camshaft; remove camshaft, being careful not to damage cam bearing with the cam lobes.

To reduce internal leakage and help maintain higher oil pressure at idle, cup plugs have been pressed into the oil galleries behind the camshaft thrust plate (Fig. 31).

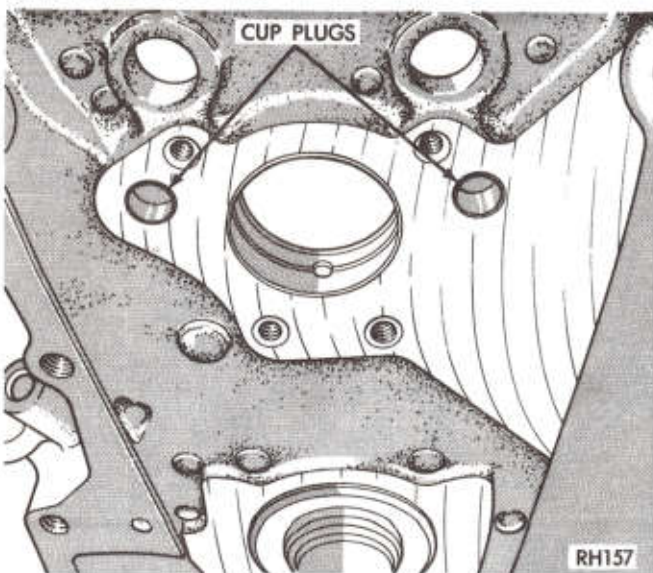


Fig. 31—Location of Cup Plugs in Oil Galleries

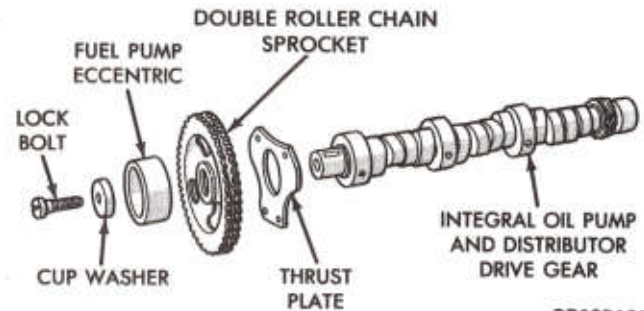


Fig. 32—Camshaft and Dual Sprocket Assembly

Installation

(1) Lubricate camshaft lobes and camshaft bearing journals and insert the camshaft to within 2 inches of its final position in cylinder block.

Whenever an engine has been rebuilt and/or a new camshaft and/or new tappets have been installed, add one pint of Chrysler Crankcase Conditioner Part Number 4318002 or equivalent to engine oil to aid in break in. The oil mixture should be left in engine for a minimum of 500 miles (805km), and drained at the next normal oil change.

(2) Install Tool C-3509 with tongue back of distributor drive gear (Fig. 33).

(3) Hold tool in position with a distributor lock plate screw. This tool will restrict camshaft from being pushed in too far and prevent knocking out the welch plug in rear of cylinder block. **Tool should remain installed until the camshaft and crankshaft sprockets and timing chain have been installed.**

(4) Install camshaft thrust plate and chain oil tab, with three screws as shown in (Fig. 34). **Make sure tang enters lower right hole in thrust plate.** Tighten to 210 in. lb. (24 N·m). Top edge of tab should be flat against thrust plate in order to catch oil for chain lubrication.

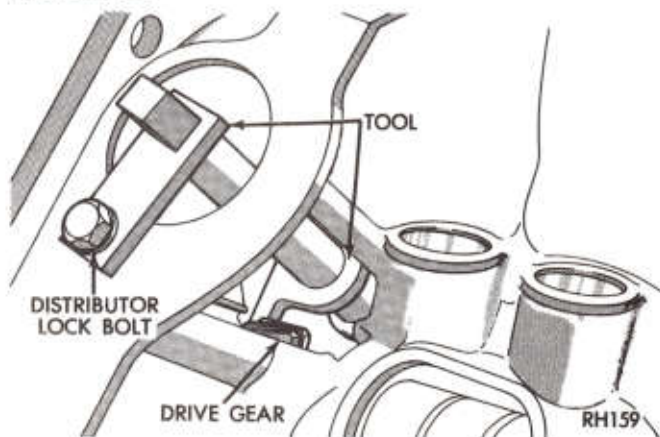


Fig. 33—Camshaft Holding Tool C-3509 in Installed Position

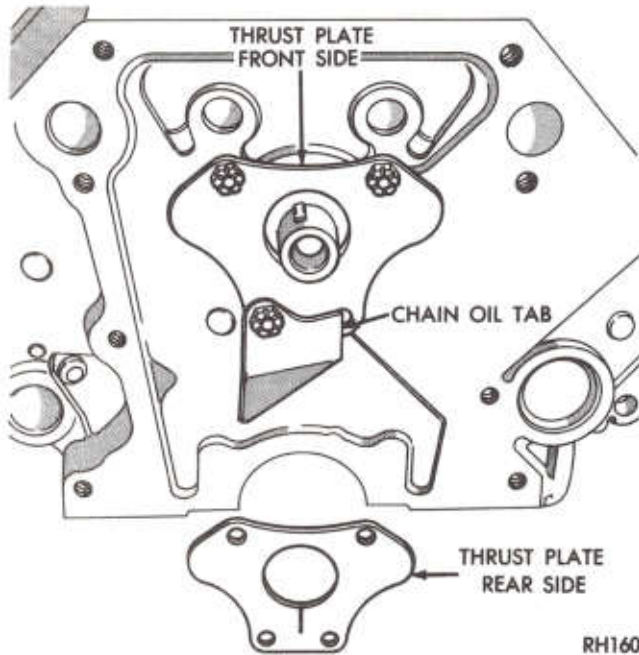


Fig. 34—Timing Chain Oil Tab Installation

(5) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(6) Place timing chain around both sprockets.

(7) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

(8) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(9) Slide both sprockets evenly over their respective shafts and use a straight edge to check alignment of timing marks (Fig. 35).

(10) Install the fuel pump eccentric, cup washer, and camshaft bolt. Tighten bolt to 35 ft. lb. (47 N·m).

(11) Measure camshaft end play. Refer to Specifications for proper clearance. If not within limits install a new thrust plate.

(12) Each tappet reused must be installed in the

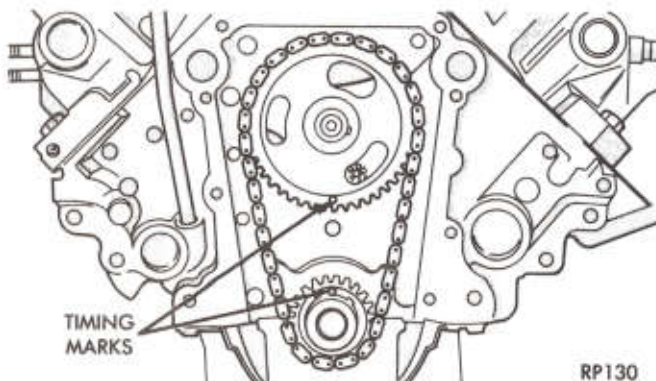


Fig. 35—Alignment of Timing Marks

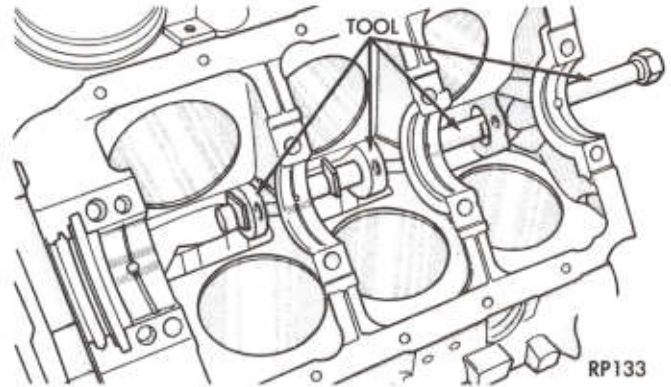


Fig. 36—Removal and Installation of Camshaft Bearings with Tool C-3132A

same position from which it was removed. Tappets must have a definite crown. When camshaft is replaced, all of the tappets must be replaced.

CAMSHAFT BEARINGS

(Engine Removed from Vehicle)

Removal

(1) With engine completely disassembled, drive out rear cam bearing core hole plug.

(2) Install proper size adapters and horse shoe washers (part of Tool C-3132-A) at back of each bearing shell to be removed and drive out bearing shells, (Fig. 36).

Installation

(1) Install new camshaft bearings with Tool C-3132-A by sliding the new camshaft bearing shell over proper adapter.

(2) Position rear bearing in the tool. Install horse-shoe lock and by reversing removal procedure, carefully drive bearing shell into place.

(3) Install remaining bearings in the same manner. Bearings must be carefully aligned to bring oil holes into full register with oil passages from the main

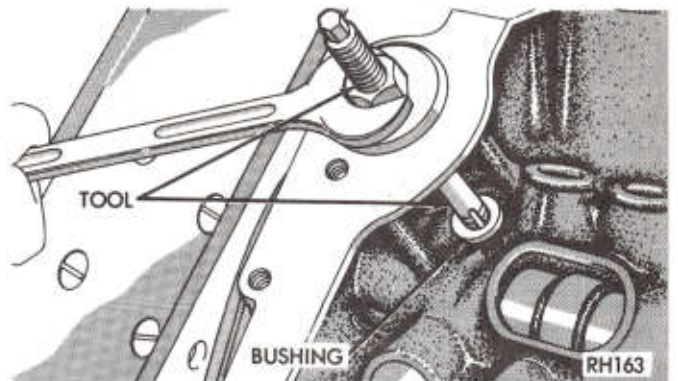


Fig. 37—Removing Distributor Driveshaft Bushing with Tool C-3052

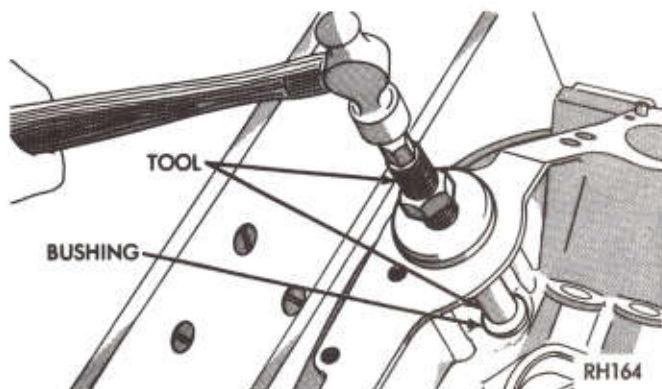


Fig. 38—Installing Distributor Driveshaft Bushing with Tool C-3053

bearing. Also, number two bearing must index with the oil passage to the left cylinder head and Number three bearing must index with the oil passage to the right cylinder head. If the camshaft bearing shell oil holes are not in exact alignment, remove and reinstall them correctly. Install a new core hole plug at the rear of camshaft. **Be sure this plug does not leak.**

DISTRIBUTOR DRIVE SHAFT BUSHING

Removal

(1) Insert Tool C-3052 into old bushing and thread down until a tight fit is obtained (Fig. 37).

(2) Hold puller screw and tighten puller nut until bushing is removed.

Installation

(1) Slide new bushing over burnishing end of Tool C-3053 and insert the tool and bushing into the bore.

(2) Drive bushing and tool into position, using a hammer (Fig. 38).

(3) As the burnisher is pulled through the bushing by tightening the puller nut, the bushing is expanded tight in block and burnished to correct size, (Fig. 39).

Do not ream this bushing.

Distributor Timing

Before installing the distributor and oil pump drive

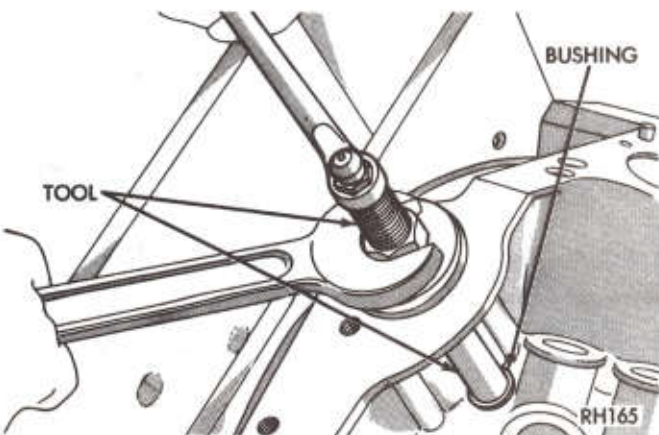


Fig. 39—Burnishing Distributor Driveshaft Bushing

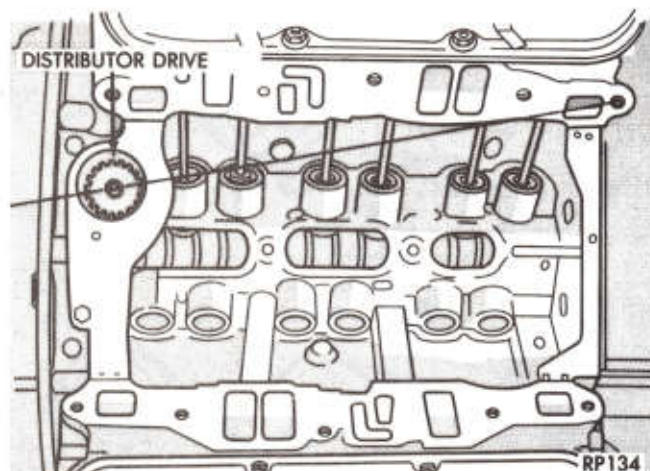


Fig. 40—Position of Installed Distributor Drive Gear

shaft, time engine as follows:

(1) Rotate crankshaft until No. 1 cylinder is at top dead center on the firing stroke.

(2) When in this position, the timing mark on vibration damper should be under ("O") on the timing indicator.

(3) Coat shaft and drive gear with engine oil. Install the shaft so that after gear spirals into place, it will index with the oil pump shaft, so slot in top of drive gear will be aligned in a direction (forward) towards left front intake manifold attaching screw hole (Fig. 40).

Installation of Distributor

(1) Hold the distributor over the mounting pad on cylinder block.

(2) Turn rotor until it points to approximate location of No. 1 tower terminal in distributor cap (Fig. 41).

(3) Place distributor O-ring in position.

(4) Lower the distributor and engage the shaft in

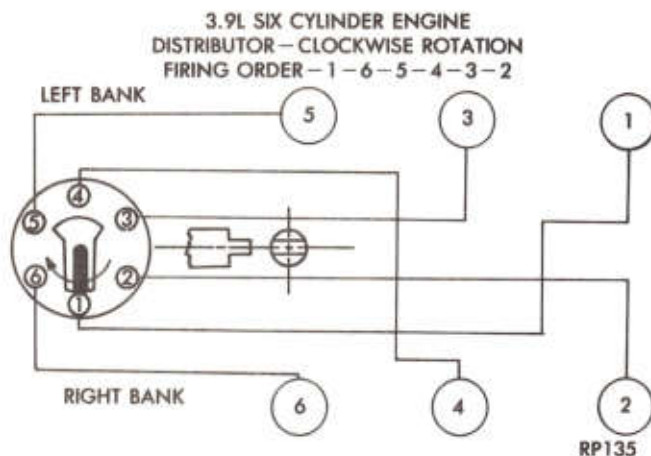


Fig. 41—Distributor with Rotor Positioned Under No. 1 Tower of Cap

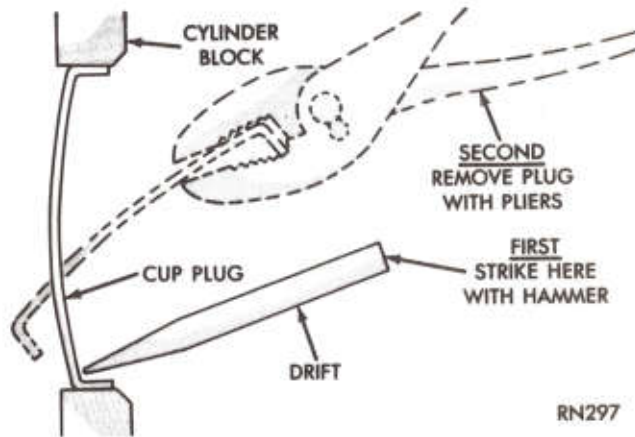


Fig. 42—Core Hole Plug Removal

the slot of distributor drive shaft gear.

CYLINDER BLOCK

Piston Removal

(1) Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation. Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so that each connection rod is centered in cylinder bore.**

(2) Inspect connecting rods and connecting rod caps for cylinder identification. Identify them if necessary.

(3) Remove connecting rod cap. Install connecting rod bolt guide set on connecting rod bolts. Push each piston and rod assembly out of cylinder bore.

Be careful not to nick crankshaft journals.

(4) After removal, install bearing cap on the mating rod.

Cleaning and Inspection

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are installed, see "Engine Core Oil and Cam Plugs."

(3) Examine block for cracks or fractures.

Cylinder Bore Inspection

The cylinder walls should be checked for out-of-round and taper with Tool C-119. If the cylinder bores show more than .005 inch (.127mm) out-of-round, or a taper of more than .010 inch (.254mm) or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operating should be closely coordinated with the fitting of pistons and rings in order that specified clearances may be maintained.

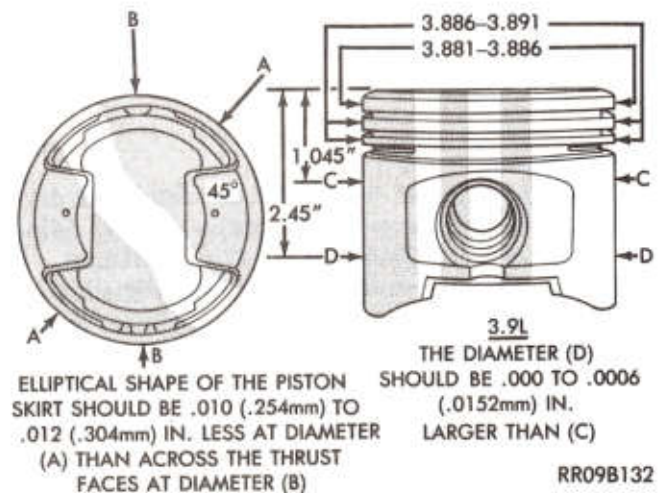


Fig. 43—Piston Measurements

ENGINE CORE OIL AND CAM PLUGS

Removal

Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 42).

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Installation

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Loctite (PN-4057987) Stud N' Bearing Mount or equivalent. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least .02 in. (0.5mm) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

PISTONS, PINS AND RINGS

The pistons are cam ground so that the diameter at the pin boss is less than its diameter across the thrust face. This allows for expansion under normal operating conditions. Under operating temperatures, expansion forces the pin bosses away from each other, thus, causing the piston to assume a more nearly round shape. It is important that pistons be checked for taper and elliptical shape before they are fitted into the cylinder bore (Fig. 43).

Finished Pistons

All pistons are machined to the same weight in

grams, regardless of oversize, to maintain piston balance. For cylinder bores which have been honed or rebored new pistons are furnished with fitted pins, available in standard and the following oversize: .020 inch (.508mm).

Fitting Pistons

Piston and cylinder wall must be clean and dry. Specified clearance between the piston and the cylinder wall is .0005 to .0015 inch (.0127 to .0381mm).

Piston diameter should be measured at the top of skirt 90 degrees to piston pin axis. Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line.

Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C).

PISTON PINS

The piston pin rotates in the piston only, and is retained by the press interference fit of the piston pin in the connecting rod.

Fitting Rings

(1) Measure piston ring gap about two inches from bottom of cylinder bore in which it is to be fitted (An inverted piston can be used to push the rings down to insure positioning rings squarely in the cylinder bore before measuring).

(2) Insert feeler stock in the gap. The ring gap should be between .010 and .020 inch (.254 and .508mm) for compression rings and .015 to .062 inch (.381 to 1.575mm) for oil ring steel rails in standard size bores (for new service rings). Maximum gap in .005 inch (.127mm) O/S bores should be .060 inch (1.524mm) for compression rings and .070 inch (1.778mm) for oil ring steel rails.

(3) Measure side clearance between piston ring and ring land (Fig. 44). Clearance should be .0015 to .003 inch (.038 to .076mm) for the top compression ring and the intermediate ring. Steel rail service oil ring

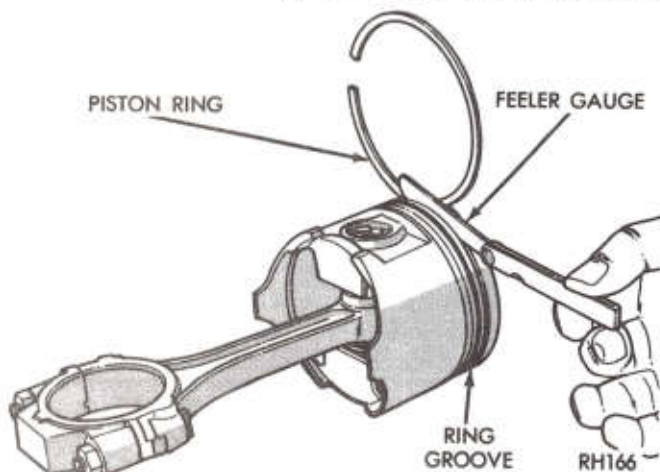
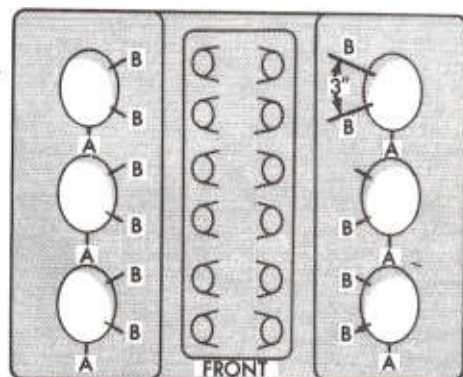


Fig. 44—Measuring Piston Ring Side Clearance



TOP VIEW OF BLOCK

A-EXPANDER GAPS

B-RAIL GAPS

IF YOU HAVE FOLLOWED THE INSTRUCTIONS, THE RING WILL BE IN THIS POSITION ON THE PISTON.

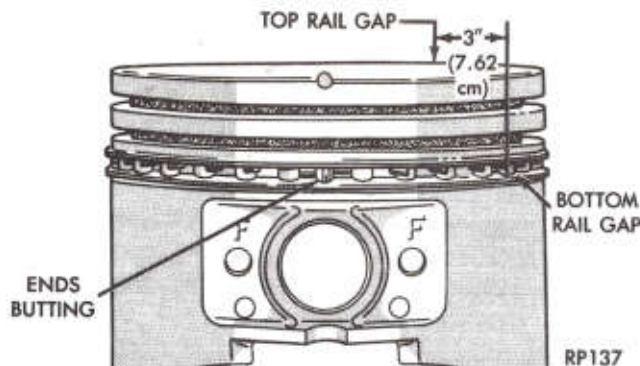


Fig. 45—Proper Oil Ring Installation

should be free in groove, but should not exceed .005 inch (.127mm) side clearance.

(4) On the 3.9L engine, the keys on the spacer expander must be inserted into the hole in the oil ring groove over the piston pin front boss. (Fig. 45).

(5) Arrange oil ring rail gaps on inboard side of piston as shown at top of (Fig. 45).

(6) Install compression rings in middle and top grooves; use Ring Installer Tool C-4184. Be sure the identification mark (a drill point, stamped letter "O", oval depression or word top) on each compression ring is to the top of the piston when ring is installed.

INSTALLING PISTON AND CONNECTING ROD ASSEMBLY

(1) Before installing pistons, and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 45).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, Tool C-385, over the piston and tighten with the special wrench (part of Tool C-385). **Be sure position of rings does not**

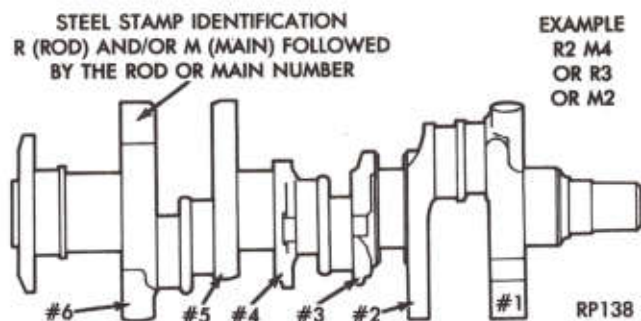


Fig. 46—Location of Crankshaft Identification on Number 6 Counterweight

change during this operation.

(4) Install connecting rod bolt protectors on rod bolts, the long protector should be installed on the numbered side of the connecting rod.

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

(6) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on crankshaft journal.

(7) The notch or groove on top of piston must be pointing toward front of engine and the larger chamfer of the connecting rod bore must be installed toward crankshaft journal fillet.

(8) Install rod caps. Install nuts on cleaned and oiled rod bolts and tighten nuts to 45 ft. lbs (61 N·m).

CONNECTING RODS

Installation of Connecting Rod Bearings

Fit all rods on one bank until completed. Do not alternate from one bank to another, because when the rods are assembled to pistons correctly, they are not interchangeable from one bank to another.

The bearing caps are not interchangeable and should be marked at removal to insure correct assembly.

Each bearing cap has a small "V" groove across the parting face. When installing the lower bearing shell, make certain that the "V" groove in the shell is in line with the "V" groove in the cap. This provides lubrication of the cylinder wall in the opposite bank.

The bearing shells must be installed so that the tangs are in the machined grooves in the rods and caps.

Limits of taper or out-of-round on any crankshaft journals should be held to .001 inch (.025mm). Bearings are available in .001 (.025mm), .002 (.051mm), .003 (.076mm), .010 (.254mm) and .012 inch (.305mm) undersize. **Install the bearings in pairs. Do not use a new bearing half with an old bearing half. Do not file the rods or bearing caps.**

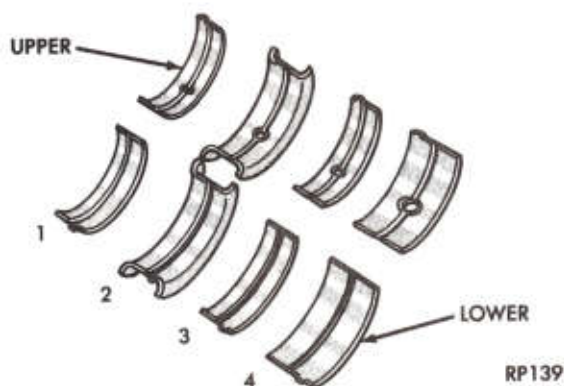


Fig. 47—Main Bearing Identification

CRANKSHAFT IDENTIFICATION

A crankshaft which has one or more connecting rod or main bearing journals undersize will be stamped with 1/4" letters near the notch of the number 6 crankshaft counterweight. (Fig. 46)

Undersize Journal	Identification Stamp
.001 inch (Rod)	R1-R2-R3-Etc.
.010 inch (Rod)	RX
.001 inch (Main)	M1-M2-M3 or M4
.010 inch (Main)	MX

"RX" indicates **all** rod journals are .010 inch undersize; "MX" indicates **all** main journals are .010 inch undersize.

CRANKSHAFT MAIN JOURNALS

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to .001 (.025mm) inch. Journal grinding should not exceed .012 (.305mm) inch under the standard journal diameter. Do NOT grind thrust faces of Number 2 main bearing. Do NOT nick crank pin or bearing fillets. After regrinding, remove rough edges from crankshaft oil holes and clean out all oil passages.

CAUTION: With the nodular cast iron crankshafts used it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

CRANKSHAFT MAIN BEARINGS

Bearing caps are not interchangeable and should be marked at removal to insure correct assembly. Upper and lower bearing halves are **NOT** interchangeable. Lower main bearing halves of 1, and 3 are interchangeable.

Upper and lower Number 2 bearing halves are flanged to carry the crankshaft thrust loads and are **NOT** interchangeable with any other bearing halves

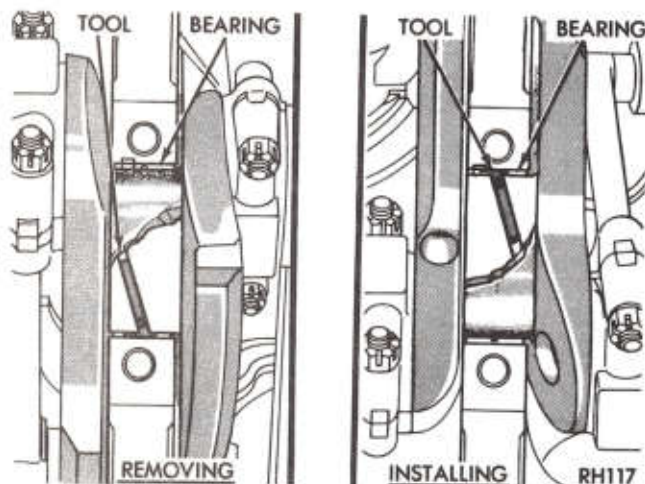


Fig. 48—Removing and Installing Upper Main Bearing with Tool C-3059

in the engine (Fig. 47). All bearing cap bolts removed during service procedures are to be cleaned and oiled before reinstallation. Bearing shells are available in standard and the following undersizes: .001 (0.25mm), .002 (.051mm), .003 (.076mm), .010 (.254mm) and .012 inch (.305mm). Never install an undersize bearing that will reduce clearance below specifications.

Removal

- (1) Remove oil pan and identify bearing caps before removal.
- (2) Remove bearing caps one at a time. Remove upper half of bearing by inserting Tool C-3059 (Fig. 48) into the oil hole of crankshaft.
- (3) Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

Installation

Only one main bearing should be selectively fitted while all other main bearing caps are properly tightened.

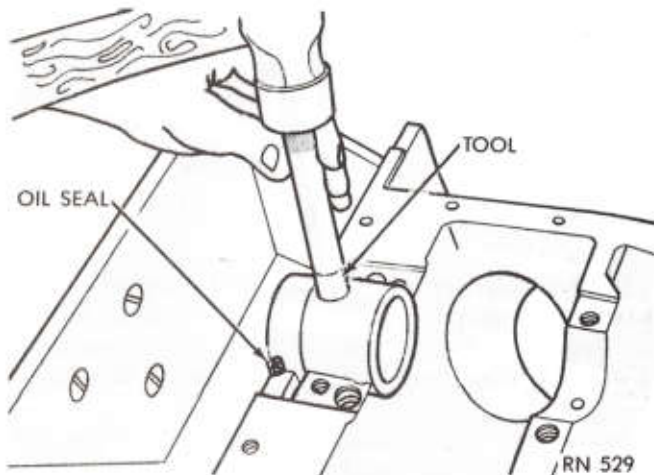


Fig. 49—Installing Upper (and Lower) Oil Seal with Tool C-3511

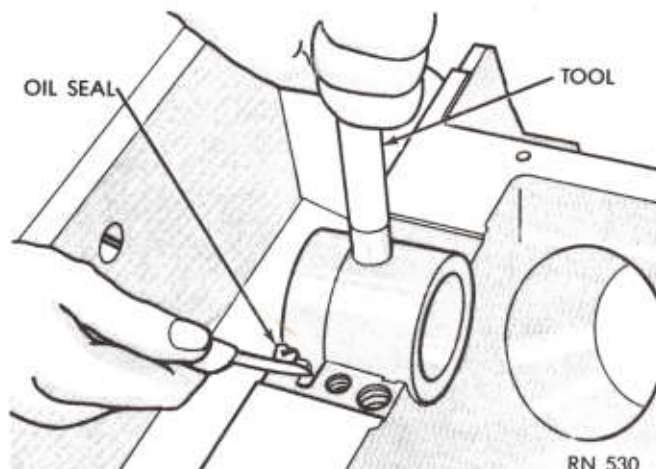


Fig. 50—Trimming Upper (or Lower) Oil Seal

When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

- (1) Start bearing in place, and insert Tool C-3059 into oil hole of crankshaft (Fig. 48).
- (2) Slowly rotate crankshaft counter-clockwise sliding the bearing into position. Remove Tool C-3059.

REAR MAIN BEARING OIL SEALS

The service seal is a two piece, fitted, "Rope Type". The upper rope seal half can be installed with crankshaft removed or in vehicle with crankshaft installed. Lower rope seal half is required installation when upper seal is installed.

Seal Service

Upper Rope Seal (Crankshaft Removed)

- (1) Install a new rear bearing oil seal in the cylinder block so that both ends protrude.
- (2) Using Tool C-3511, tap seal down into position until tool is seated in bearing bore (Fig. 49).
- (3) Hold tool in this position and cut off the portion of seal that extends below the block (or cap) on both sides (Fig. 50).

Upper Rope Seal (In Vehicle—Crankshaft Installed)

- (1) Remove defective upper seal and install new one using "Oil Seal Remover and Installer Tool KD-492" or equivalent (which includes complete instructions and is available from most auto supply stores).
- (2) Carefully, trim the upper seal after installation to eliminate frayed ends.

Lower Rope Seal

- (1) Install a new seal in bearing cap so that both ends protrude.
- (2) Using Tool C-3511, tap seal down into position until tool is seated in bearing bore.

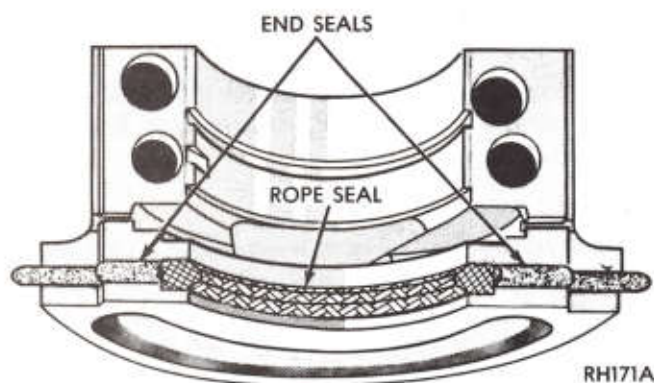


Fig. 51—Rear Main Bearing Cap

(3) Hold tool in this position and cut off the portion of the seal that extends above the cap on both sides.

(4) Install cap seals into slots in bearing cap (Fig. 51). If this is not done, oil leakage will occur. Lightly oil seals with engine oil.

(5) Assemble bearing cap to cylinder block. Install cleaned and oiled cap bolts and torque to 85 ft. lbs.

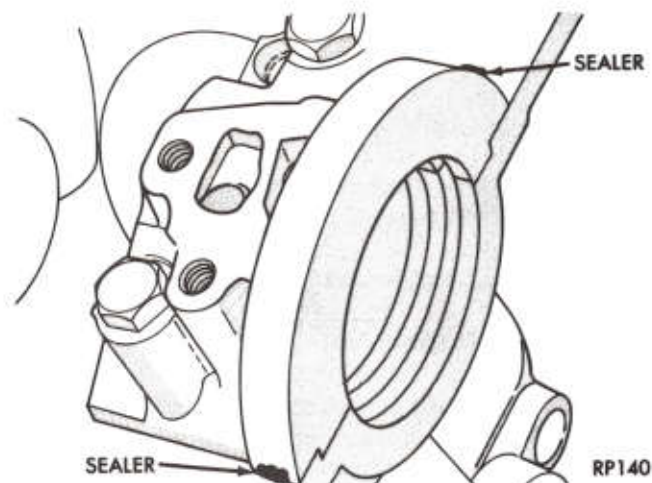


Fig. 52—Oil Pan End Seal at Rear Bearing

(115 N·m).

(6) Reinstall oil pump. Add sealer at bearing cap to block joint (Fig. 52) to provide oil pan end sealing. Install oil pan.

ENGINE OIL SYSTEM (FIG. 53)

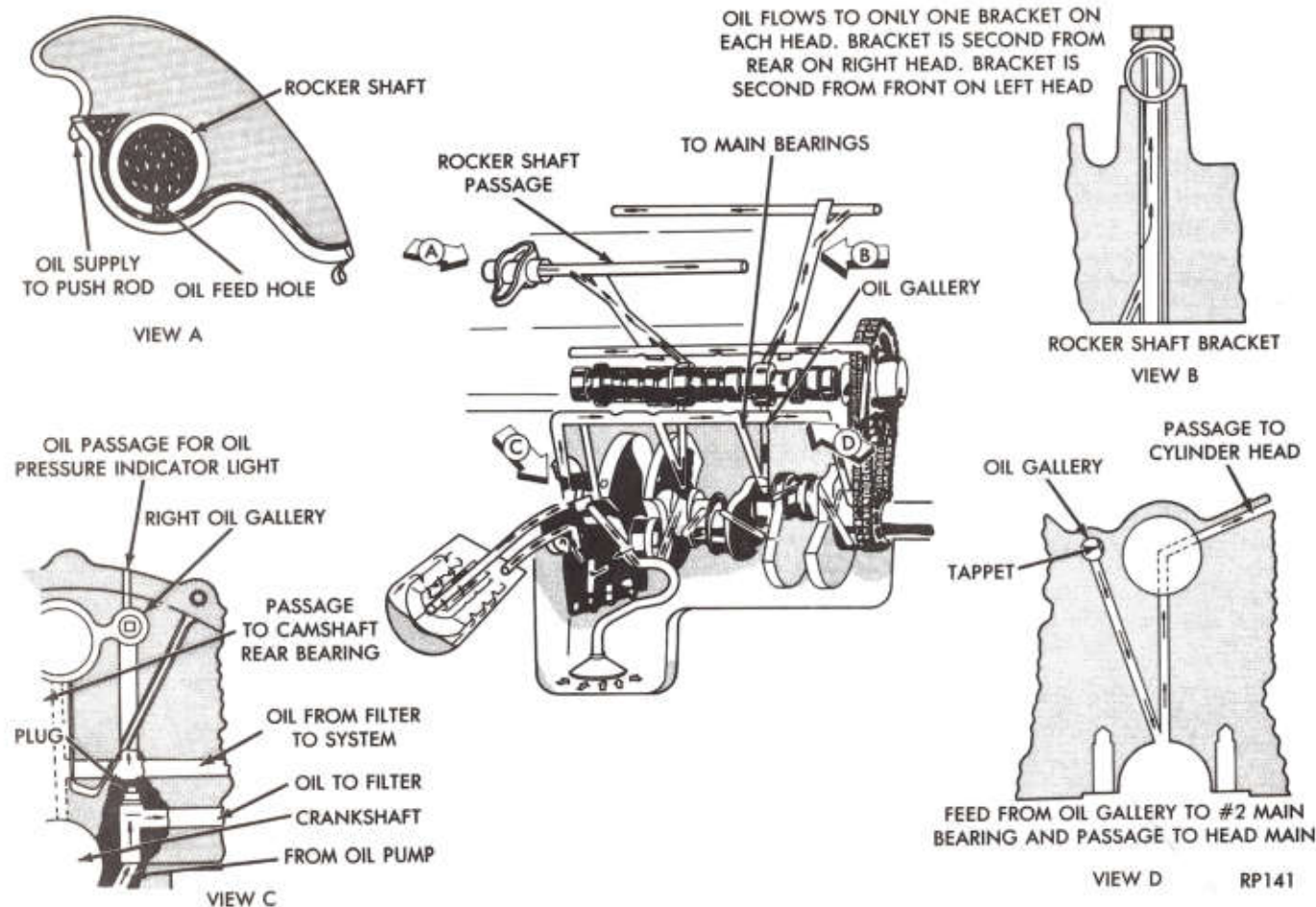


Fig. 53—Engine Oiling System

OIL PAN

Removal

- (1) Disconnect battery ground cable; remove engine oil dipstick.
- (2) Raise vehicle. Drain engine oil, remove exhaust crossover pipe and remove left engine to transmission strut.
- (3) Remove oil pan screws and remove oil pan.

Cleaning and Inspection

- (1) Clean oil pan in solvent and wipe dry with a clean cloth. Clean all gasket material from mounting surfaces of pan and block.
- (2) Inspect oil drain plug and plug hole for stripped or damaged threads and repair as necessary. Install a new drain plug gasket. Tighten to 20 ft. lb. (27 N·m).
- (3) Inspect oil pan mounting flange for bends or distortion. Straighten flange if necessary.
- (4) Clean oil screen and pipe thoroughly in clean solvent. Inspect condition of screen.

Installation

- (1) Place a drop of RTV at chain case cover to block parting line.
- (2) Using a new pan gasket set, add drop of RTV sealer at corners of rubber and cork (Fig. 54).
- (3) Install pan and tighten screws to 200 in. lb. (23 N·m).
- (4) Install engine to transmission strut.
- (5) Install exhaust cross over pipe. Tighten to 24 ft. lb. (33 N·m).
- (6) Lower vehicle and install oil dipstick.
- (7) Connect battery ground cable.
- (8) Fill crankcase with oil to proper level.

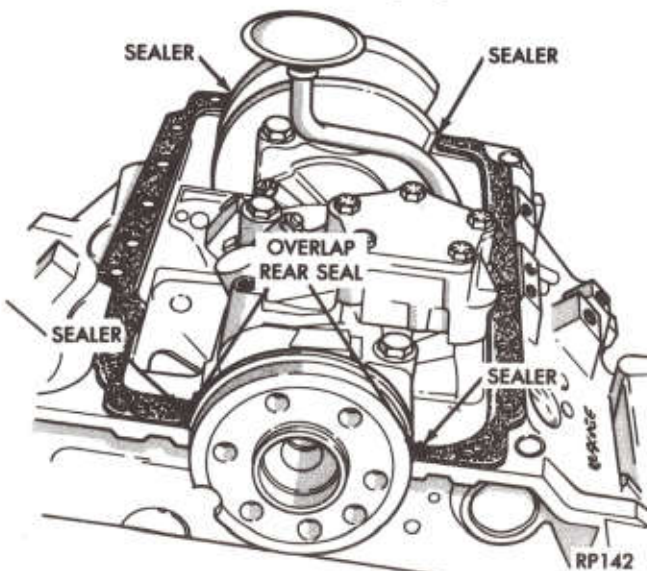


Fig. 54—Oil Pan Gaskets and Seal Installation

OIL PUMP

It is necessary to remove the oil pan, and remove the oil pump from rear main bearing cap to service the oil pump.

Disassembly

- (1) To remove the relief valve, proceed as follows:
 - (a) Remove cotter pin, drill a 1/8 (3.175mm) inch hole into the relief valve retainer cap and insert a self-threading sheet metal screw into cap.
 - (b) Clamp screw into a vise and while supporting oil pump, remove cap by tapping pump body using a soft hammer. Discard retainer cap and remove spring and relief valve (Fig. 55).

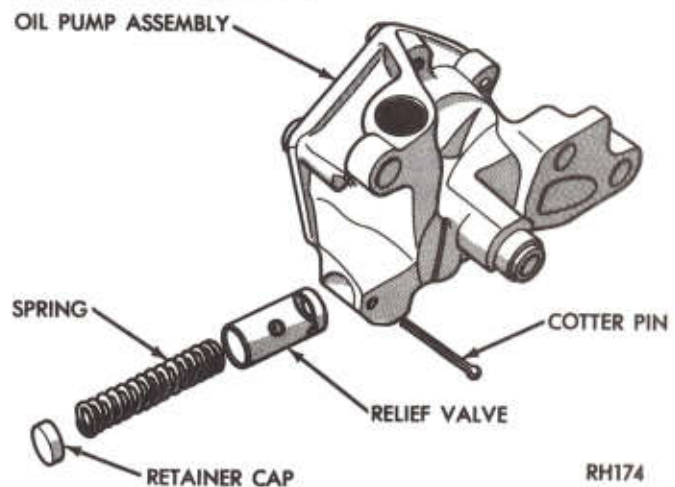


Fig. 55—Oil Pressure Relief Valve

- (2) Remove oil pump cover bolts and lock-washers, and lift off cover.
- (3) Remove pump rotor and shaft, and lift out outer rotor.
- (4) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 56).

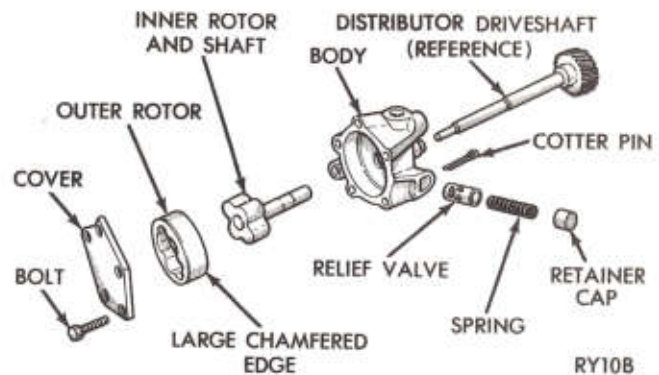


Fig. 56—Oil Pump

Inspection and Repair

- (1) Clean all parts thoroughly. Mating surface of

the oil pump cover should be smooth. Replace pump assembly if cover is scratched or grooved.

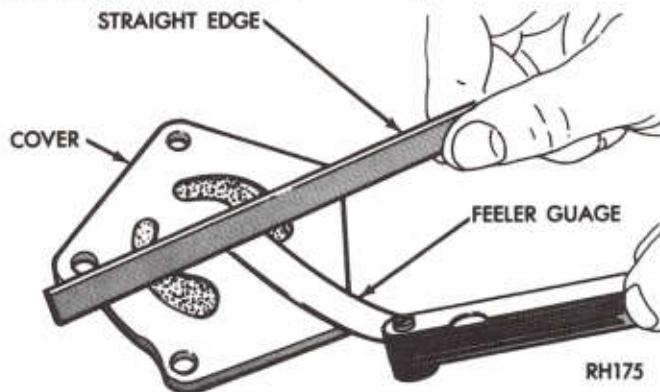


Fig. 57—Checking Oil Pump Cover Flatness

(2) Lay a straight edge across the pump cover surface (Fig. 57). If a .0015 inch (.038mm) feeler gauge can be inserted between cover and straight edge, pump assembly should be replaced.

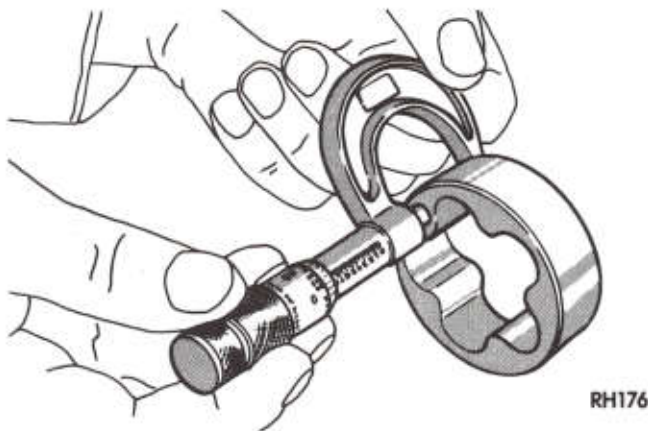


Fig. 58—Measuring Outer Rotor Thickness

(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures .825 inch (20.9mm) or less on 3.9L engine, (Fig. 58) or if the diameter is

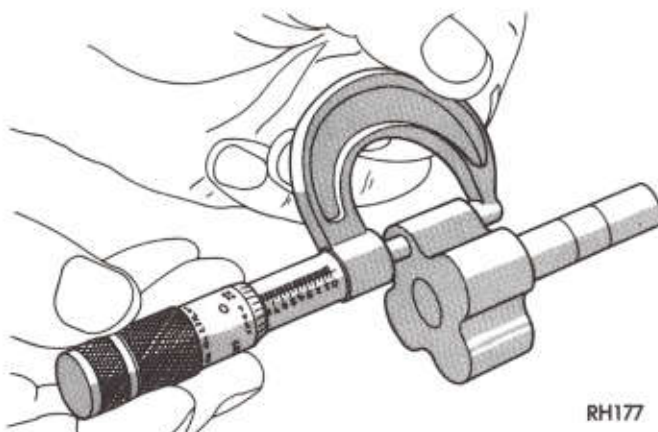


Fig. 59—Measuring Inner Rotor Thickness

2.69 inches (62.7mm) or less, replace outer rotor.

(4) If inner rotor measures .825 inch (20.9mm) or less replace inner rotor and shaft assembly (Fig. 59).

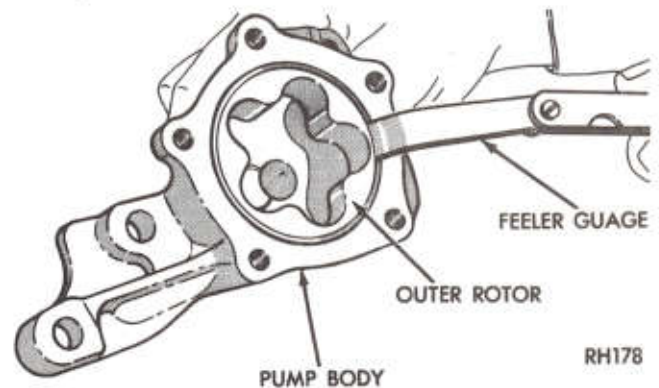


Fig. 60—Measuring Outer Rotor Clearance in Housing

(5) Slide outer rotor into pump body, press to one side with fingers and measure clearance between rotor and pump body (Fig. 60). If measurements is .014 inch (.356mm) or more, replace oil pump assembly.

(6) Install inner rotor and shaft into pump body. If

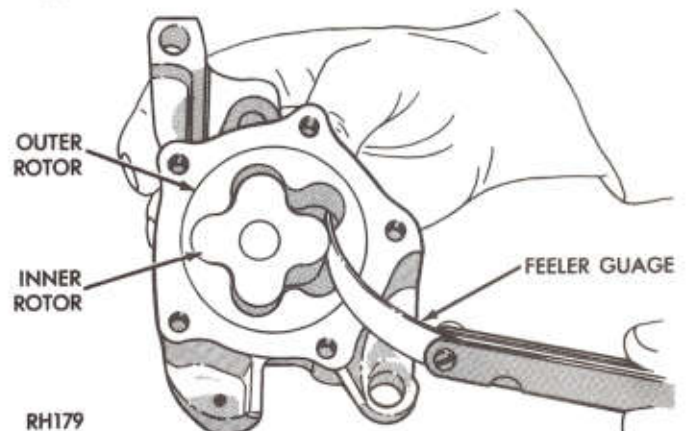


Fig. 61—Measuring Clearance Between Rotors

clearance between inner and outer rotors (Fig. 61) is .008 inch (.203mm) or more, replace shaft and both rotors.

(7) Place a straight edge across the face of the pump, between bolt holes. If a feeler gauge of .004 inch (.102mm) or more can be inserted between rotors and the straight edge, replace pump assembly (Fig. 62).

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

(9) The relief valve spring has a free length of approximately 1.95 inches (49.5mm) and should test between 191.5 and 20.5 pounds when compressed to

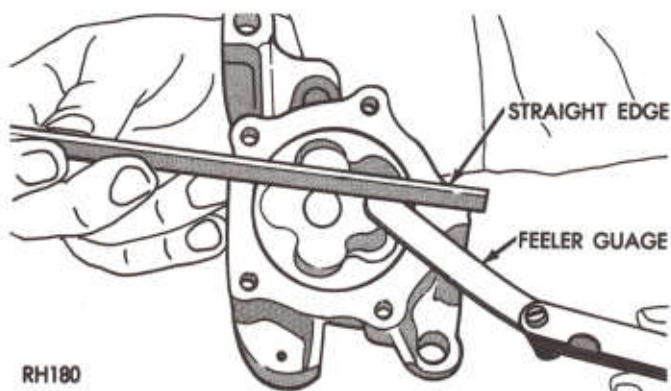


Fig. 62—Measuring Clearance Over Rotors

1-11/32 inch (34mm). Replace spring that fails to meet specifications. (Fig. 63).

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

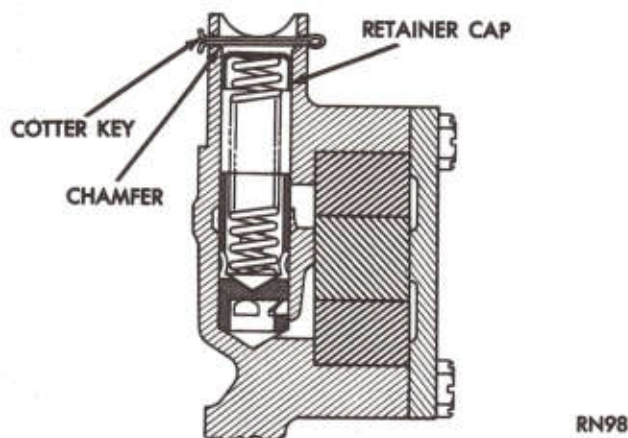


Fig. 63—Proper Installation of Retainer Cap

Oil Pump Assembly and Installation

- (1) Assemble pump, using new parts as required.
- (2) Tighten cover bolts to 96 in. lb. (11 N·m).
- (3) Prime oil pump before installation by filling rotor cavity with engine oil.
- (4) Install oil pump. During installation slowly rotate pump body to ensure driveshaft-to-pump rotor shaft engagement while holding oil pump base flush against mating surface on number 4 main bearing cap, fully finger tighten pump attaching bolts. Torque attaching bolts to 30 ft. lbs. (41 N·m).

OIL LINE PLUG

The oil line plug is located in the vertical passage in

the block between the Oil-To-Filter and Oil-From-Filter passages. (Fig. 53). Misinstallation or absence could cause erratic, low or no oil pressure.

Inspection

- (1) Remove oil pressure sending unit from back of block.
- (2) Insert a 1/8" finish (3.175mm) wire or equivalent into passage.
- (3) Plug should be 7-1/2 to 7-11/16 inches (190 to 195.2mm) from machined surface of block. (See Fig. 53), and 2-1/8 to 2-5/16 inches (54.0 to 57.7mm) from bottom of the block.
- (4) If plug is too high, use a suitable flat dowel drift to position properly.
- (5) If plug is off position. Remove oil pan and No. 4 main bearing cap. Use suitable flat dowel to remove plug.
- (6) Upon reinstallation, use stud n' bearing mount adhesive P/N 4057987 on outside diameter of plug to insure retention of position. Assemble engine and check oil pressure.

OIL FILTER

The oil filter should be replaced to coincide with every second oil change.

- (1) Using Tool C-4065, unscrew filter from base and discard (Fig. 64).
- (2) Wipe base clean, then inspect gasket contact surface.
- (3) Lubricate gasket of new filter with clean engine oil.
- (4) Install and tighten filter to 15 foot pounds torque, or 3/4 to 1 turns after gasket contacts base. Use filter wrench, if necessary.
- (5) Start engine and check for leaks.

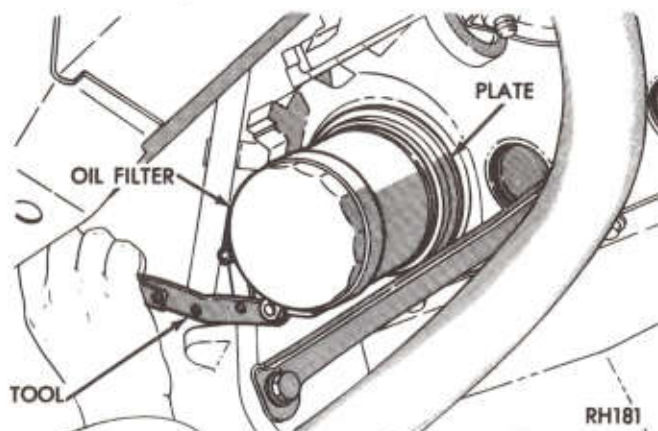


Fig. 64—Removing Oil Filter with Tool C-4065

3.9L ENGINE

ENGINE

Type	90° V
Number of Cylinders	6
Bore	3.91"
Stroke	3.31"
Piston Displacement	238 cu. in.—(3.9L)
Compression ratio	9.0 to 1
Minimum Compression Pressure, see "Engine Performance" in Standard Service Procedures	100 psi
Maximum Variation between Cylinders (any one engine)	25%
Firing Order	1-6-5-4-3-2
Basic Timing	Refer to Emission Control Information Label on Vehicle

CYLINDER NUMBER (front to rear)

Left Bank	1-3-5
Right Bank	2-4-6

CYLINDER BLOCK

Cylinder Bore (standard)	3.910"—3.912"
Cylinder Bore Out-of-Round (Maximum allowable before reconditioning)	.005"
Cylinder Bore Taper (Maximum allowable before reconditioning)	.010"
Reconditioning Working Limits (for taper and out-of-round)	.001"
Maximum Allowable Oversize (cylinder bores)	.040"
Tappet Bore Diameter	.9051"—.9059"
Distributor Lower Drive Shaft Bushing (press fit in block)	.0005"—.014"
Shaft to Bushing Clearance	.0007"—.0027"

PISTONS

Type Material	Alloy Tin Coated
Land Clearance (Diametrical)	.019"—.024"
Clearance at Top of Skirt	.0005"—.0015"
Weight (Std. through .040" oversize)	592 gms.
Piston Length (overall)	3.47"
Ring Groove Depth	
No. 1	.205"
No. 2	.205"
No. 3	.194"
Pistons for Service	Standard and .020" Oversize

PISTON PINS

Type	Press Fit in Rod
Diameter	.9841"—.9843"
Length	2.990"—.3020"
Clearance in Piston (Light Thumb Push @ 70°F.)	.0000"—.0005"
End Play	None
Clearance in Rod	.0007"—.0014"
	(Interference)
	Standard .003"
Pins for Service	and .008" oversize

3.9L ENGINE

ENGINE

PISTON RINGS

Number of Rings per Piston	3
Compression	2
Oil	1
Oil Ring Type	3-piece steel rail chrome-face
Ring Width	
Compression	
Oil—Steel rails	.0770"—.0780"
Ring Gap	.0252" Max
Compression	
Oil—Steel rails	.010"—.020"
Ring Side Clearance	.015"—.055"
Compression	
Oil—Steel rails	.0015"—.0030"
Service Rings	.0002"—.005"
Ring Gap	
Compression	
Oil (Steel rails)	.010"—.020"
Ring Side Clearance	.010"—.062"
Compression	
Oil (Steel rails)	.0015"—.004"
	.0002"—.005"

CONNECTING RODS

Length (Center to Center)	6.121"
Weight (less bearing shells)	726 Grams
Side Clearance (two rods)	.006"—.014"
Piston Pin Bore Diameter	.9819"—.9834"

CONNECTING ROD BEARINGS

Type	Tri-Metal
Diameter and Width	2.126"x.842"
Clearance Desired	.0005"—.0022"
Maximum Allowable	.0022"
Bearings for Service	Std., .001", .002", .010", .012"

CRANKSHAFT

Type	Counter-Balanced
Bearings	Aluminum Lead
Thrust Taken By	No. 2 Main Bearing
End Play	.002"—.007"
Maximum Allowable	.010"
Diametral Clearance Desired # 1	.0005"—.0015"
Maximum Diametral Clearance Allowed # 1	.0015"
Diametral Clearance Desired # 2, 3 and 4	.0005"—.0020"
Diametral Clearance Allowed # 2, 3 and 4	.0025"
Finish at Rear Oil Seal Surface	Diagonal Knurling

MAIN BEARING JOURNALS

Diameter	2.4995"—2.5005"
Maximum Allowable Out-of-Round and/or Taper	.001"
Bearings for Service Available in	.001", .002", .003", .010", .012"
Standard and the following undersizes	

CONNECTING ROD JOURNALS

Diameter	2.124"—2.125"
Maximum Allowable Out-of-Round and/or Taper	.001"

3.9L ENGINE

ENGINE

CAMSHAFT

Drive	Chain
Bearings	Steel Backed Babbitt
Number	4
Diametral Clearance	.001"—.003"
Maximum Allowable Before Reconditioning	.005"
Thrust Taken By	Thrust Plate
End Play	.002"—.010"
Maximum Allowable	.010"

CAMSHAFT JOURNALS

Diameter	
No. 1	1.998"—1.999"
No. 2	1.967"—1.968"
No. 3	1.951"—1.952"
No. 4	1.5605"—1.5615"

CAMSHAFT BEARINGS

Diameter	
No. 1	2.000"—2.001"
No. 2	1.984"—1.985"
No. 3	1.953"—1.954"
No. 4	1.5625"—1.5635"

VALVE TIMING

Intake Opens (BTC)	10°
Intake Closes (ABC)	50°
Exhaust Opens (BBC)	52°
Exhaust Closes (ATC)	16°
Valve Overlap	26°
Intake Valve Duration	240°
Exhaust Valve Duration	248°

TIMING CHAIN

Number of Links	68
Pitch	.375"
Width	.625"

TAPPETS

Type	Hydraulic Roller
Body Diameter	.9035"—.9040"
Clearance in Block	.0011"—.0024"
Service Tappets Available	Std., .001", .008", .030"
Dry Lash	.060"—.210"
Push Rod Length	6.794"—6.814"

CYLINDER HEAD

Valve Seat Run-Out (Maximum)	.003"
Intake Valve Seat Angle	45°—45-1/2°
Seat Width (finish)	.065"—.085"
Exhaust Valve Seat Angle	45°—45-1/2°
Seat Width (finish)	.080"—.100"
Cylinder Head Gasket (Thickness compressed)	.033"

VALVE GUIDES

Type	Cast in Head
Guide Bore Diameter	.374"—.375" (Std.)

VALVES—(INTAKE)

Head Diameter	1.780"
Length (overall)	4.962"—4.987"
Stem Diameter (Standard)	.372"—.373"
Stem to Guide Clearance	.001"—.003"
Maximum Allowable by rocking method	.017"
Face Angle	44-1/2°—45°
Valves for Service (oversize stem diam.)	Std., .005", .015", .030"
Lift (Zero Lash)	.373"

3.9L ENGINE

ENGINE	3.9L
VALVES—(EXHAUST)	
Head Diameter	1.517"
Length overall Without Rotators	4.969"—5.005"
Length overall With Rotators	4.977"—5.012"
Stem Diameter (Standard)	.371"—.372"
Stem to Guide Clearance	.002"—.004"
Maximum Allowable by rocking method	.017"
Face Angle	44-1/2°—45°
Valves for Service (oversize stem diam.)	Std., .005", .015", .030"
Lift (Zero Lash)	.400"

ENGINE VALVE SPRINGS	3.9L	
LOCATION/IDENTIFICATION	Intake	Exhaust (With Rotator)
Number	6	6
Color	Blue	White
Free Length (Approx.)	2.00"	1.81"
Wire Diameter	.192"	.185"
Number of coils	6.4	5.8
Load when compressed to (valve closed)	78-88 lbs. @ 1-11/16"	80-90 lbs. @ 1-13/64"
Load when compressed to (valve open)	170-184 lbs. @ 1-5/16"	180-194 lbs. @ 1-1/16"
Maximum allowable out of plumb	1/16"	1/16"
Valve spring installed height (spring seat to retainer)	1-5/8"—1-11/16"	1-29/64"—1-33/64"
Use 1/16" spacer to reduce spacing height when over specifications		

ENGINE LUBRICATION	3.9L
Pump Type	Rotary Full Pressure
Capacity (qts.) U.S.	4 (with or without filter)
Pump Drive	Camshaft
Minimum Pressure, Engine Fully warmed up	
Curb Idle	6 psi
3000 RPM	30—80 psi
Oil Filter Bypass Valve Setting	9 to 15 psi
Oil Pressure Switch Minimum Actuating Pressure	5 to 7 psi
Oil Filter Type	Full Flow

OIL PUMP—INSPECTION LIMITS FOR REPLACEMENT 3.9L

	3.9L
Oil Pump Cover Out of Flat	.0015 inch or more
Outer Rotor Thickness	.825 inch or less
Outer Rotor Diameter	2.469 inch or less
Inner Rotor Thickness	.825 inch or less
Clearance Over Rotors—Outer	.004 inch or more
Inner	.004 inch or more
Outer Rotor Clearance	.014 inch or more
Tip Clearance Between Rotors	.008 inch or more

OVERSIZE AND UNDERSIZE ENGINE COMPONENT MARKINGS—3.9L

Displacement	Condition	Identification	Location of Identification
3.9L	.001" U/S Crankshaft	R or M M-2-3 etc. (indicating No. 2 & 3 main bearing journal) and/or R-1-4 etc. (indicating No. 1 & 4 connecting rod journal)	Steel stamped (near notch) on number six crankshaft counterweight
	.010" U/S Crankshaft	RX or MX MX (Indicates .010" U/S all main journals) and/or RX (Indicates .010" U/S all rod journals)	Steel stamped (near notch) on number six crankshaft counterweight
	.020" O/S Cylinder Bores	A	Following engine serial number
	.008" O/S Tappets	◆	3/8" diamond shaped stamp Top pad—Front of engine and flat ground on outside surface of each O/S tappet bore.
	.005" O/S Valve Stems	X	Milled pad adjacent to two 3/8" tapped holes on each end of cylinder head

TIGHTENING REFERENCE 3.9L ENGINE TORQUES

	Thread Size	★Torque Foot-Pounds	★Newton Meters
Alternator Adjusting Strap Bolt	5/16"—18	200 in.-lbs.	(23)
Alternator Adjusting Strap Mounting Bolt	3/8"—16	30	(41)
Alternator Bracket Bolt	3/8"—16	30	(41)
Alternator Mounting Pivot Nut	3/8"—16	30	(41)
Camshaft Sprocket Lockbolt	7/16"—14	50	(68)
Camshaft Thrust Plate	5/16"—18	210 in.-lbs.	(24)
Chain Case Cover Bolt	3/8"—16	35	(47)
Clutch Housing Bolt	3/8"—16	30	(41)
	7/16"—14	50	(68)
Connecting Rod Nut	3/8"—24	45	(61)
Crankshaft Bolt (Vibration Damper)	3/4"—16	135	(181)
Cylinder Head Bolt	1/2"—13	105	(143)
Cylinder Head Covers—Nut	1/4"—20	80 in.-lbs.	(9)
Stud	1/4"—20	115 in.-lbs.	(13)
Distributor Clamp Bolt	5/16"—18	200 in.-lbs.	(23)
Engine Front Mount Insulator to Frame		30	(41)
Engine Front Mount Insulator to Engine Bracket		75	(102)
Engine Rear Mount Insulator to Crossmember Bracket		30	(41)
Engine Rear Mount Insulator to Extension Bracket		50	(68)
Exhaust Manifold Screw	5/16"—18	20	(27)
Nut	5/16"—24	15	(20)
Exhaust Pipe Flange Nut	7/16"—14	24	(33)
Fan Blade Attaching Bolts	5/16"—18	200 in.-lbs.	(23)
Flex Plate to Converter	5/16"—24	270 in.-lbs.	(31)
Flex Plate to Crankshaft	7/16"—20	55	(75)
Flywheel to Crankshaft	7/16"—20	55	(75)

*All Critical Fasteners should be clean and lightly oiled.

3.9L ENGINE (Tightening Reference - Continued)

	Thread Size	★Torque Foot-Pounds	★Newton Meters
Intake Manifold Bolt	3/8"—16	45	(61)
Main Bearing Cap Bolt	1/2"—13	85	(115)
Oil Pan Drain Plug	1/2"—20	20	(27)
Oil Pan Screw	5/16"—18	200 in.-lbs.	(23)
Oil Pump Cover Bolt	1/4"—20	95 in.-lbs.	(11)
Oil Pump Attaching Bolt	3/8"—16	30	(41)
Oil Filter Attaching Stud	3/4"—16	50	(61)
Oil Pressure Gauge Sending Unit	1/8" NPTF	60 in.-lbs.	(7)
Rocker Shaft Bracket Bolt (Also See Text)	5/16"—18	200 in.-lbs.	(23)
Spark Plug	14mm	30	(41)
Starter Mounting Bolt	7/16"—14	50	(68)
Temperature Gauge Sending Unit	1/8"—NPTF	60 in.-lbs.	(7)
Vibration Damper Screw to Crankshaft	3/4"—16	100	(136)
Water Pump to (Chain Case Cover) Bolt	3/8"—16	30	(41)
A/C Compressor Bracket to Water Pump Bolt	3/8"—16	30	(41)
A/C Compressor to Bracket Bolt	7/16"—14	50	(68)
A/C Compressor Support Bolts	3/8"—16	30	(41)

★All Critical Fasteners should be cleaned and lightly oiled.

318-360 CUBIC INCH ENGINES

INDEX

	Page		Page
318-360 Engine(s) - Information	37	Measuring Connecting Rod Bearing Clearance ...	3
Camshaft	49	Measuring Main Bearing Clearance	3
Camshaft Bearings	50	Oil Filter	61
Connecting Rods	55	Oil Line Plug	60
Crankshaft Identification	54	Oil Pan	58
Crankshaft Main Bearings	55	Oil Pump	58
Crankshaft Main Journals	55	Oversize and Undersize Engine Component	
Crankcase Ventilation System	2	Markings	66
Cylinder Block	52	Pistons, Pins, and Rings	53
Cylinder Heads	41	Rear Main Bearing Oil Seal	56
Distributor Drive Shaft Bushing	51	Repair of Damaged or Worn Threads	4
Engine Core and Cam Plugs	52	Rocker Arms and Shaft Assembly	40
Engine Mounts	39	Specifications	62-66
Engine Performance	1	Tightening Reference	67
Engine Removal	38	Timing Chain Cover, Oil Seal and Chain	47
Honing Cylinder Bores	2	Valves and Valve Springs	43
Hydraulic Tappets	46		
Installing Piston and Connecting Rod			
Assembly	55		

318-360 ENGINE(S) INFORMATION

Engines	318	360
Type (Configuration/Cylinders)	V8	V8
Bore	3.91 in. (99.3mm)	4.0 in. (101.6mm)
Stroke	3.31 in. (84.1mm)	3.58 in. (90.93mm)
Compression Ratio	9.2:1	8.1:1
(Brake, Horsepower)	(170 @ 4,000 RPM)	(185 @ 4,000 RPM)
(Torque—Lb. Ft.)	(260 @ 2,000 RPM)	(283 @ 1,600 RPM)
Fed. Cal.	—	7.7:1
Light Duty	—	(190 @ 4,000 RPM)
Emission Package	—	(285 @ 1,600 RPM)
Fed. Cal.	—	7.7:1
Heavy Duty	—	(190 @ 4,000 RPM)
Emission Package	—	(285 @ 1,600 RPM)
Canada	—	7.7:1
Heavy Duty	—	(203 @ 4,000 RPM)
Emission Package	—	(296 @ 2,800 RPM)
Fuel and Induction	TBI with Water Cooled	Carburetor—4V
Intake Manifold	318 C.I. (5.2 Liters)	360 C.I. (5.9 Liters)
Displacement	1-8-4-3-6-5-7-2	1-8-4-3-6-5-7-2
Firing Order	Hydraulic (Roller)	Hydraulic (Flat)
Tappets—Type	Pressure Feed—	Pressure Feed—
Lubrication	Full Flow Filtration	Full Flow Filtration
Engine Oil Pump	Rotor Type—	Rotor Type—
Engine Oil Capacity	Internally Mounted	Internally Mounted
	4 Quarts (3.8 Liters)	4 Quarts (3.8 Liters)
	Plus Add 1 Quart with	Plus Add 1 Quart With
	Filter Change	Filter Change
Cooling System	Liquid Cooled—	Liquid Cooled—
Cooling System Capacity	Forced Circulation	Forced Circulation
	17 Qts. (16L) L.D.	15.5 Qts. (14.7L) L.D.
	16.5 Qts. (15.6L) H.D.	15 Qts. (14.5L) H.D.
Combustion Chambers	Wedge with High Swirl	Wedge
Block—Manifold—Heads	Valve Shrouding	
Crankshaft	Cast Iron	Cast Iron
Connecting Rods	Nodular Iron	Nodular Iron
Pistons	Forged Steel	Forged Steel
	Aluminum Alloy with Strut	Aluminum Alloy with Strut
	(Top Flat/Top Ring Chrome)	(Top Dished/Top Ring Moly)

ENGINE

The V8 engines are all the valve-in head type with hydraulic tappets. Engines vary in compression ratio, piston displacement, camshafts, valve springs, carburetors, intake manifolds and exhaust systems. All engines are designed to use regular or low lead fuel.

SERVICE PROCEDURES

ENGINE REMOVAL (If Equipped with Manual Transmission See Group 21).

- (1) Scribe hood hinge outlines on hood and remove hood.
- (2) Drain cooling system and remove battery and carburetor air cleaner.
- (3) Remove radiator and heater hoses and remove radiator. Set fan shroud aside.
- (4) Discharge air conditioning, refer to Group 24 Air Conditioning for service procedures if so equipped.
- (5) Remove vacuum lines, distributor cap and wiring.
- (6) Remove carburetor, linkage, starter wires and oil pressure wire.
- (7) Remove air conditioning hoses and power steering hoses if so equipped.
- (8) Remove starter motor, alternator, charcoal canister and horns.
- (9) Disconnect exhaust pipe at manifold.
- (10) Remove ball housing bolts and inspection plate. Attach "C" clamp on front bottom of transmission torque converter housing to prevent torque converter from coming out.
- (11) Remove torque converter drive plate bolts from torque converter drive plate. Mark converter and drive plate to aid in reassembly.
- (12) Support transmission with a transmission stand tool number C-3201-A in its normal position relative to the vehicle. This will assure that the torque converter will remain in proper position in the transmission housing.
- (13) Disconnect the engine from the torque converter drive plate.
- (14) Install engine lifting fixture. Attach a chain hoist to fixture eyebolt.
- (15) Remove engine front mount bolts.
- (16) Remove engine from engine compartment and install in engine repair stand.

Installation

- (1) Remove engine from repair stand and install in engine compartment.
- (2) Install torque converter drive plate bolts and front end mounts.
- (3) Install bell housing bolts. Remove "C" clamp

No lead fuel only with catalytic converter in exhaust system.

Engine oiling system consists of a rotor type oil pump with a full flow oil filter. On the 318 (5.2L), and 360 (5.9L) cubic inch engines, the pump is mounted internally.

and install inspection plate. Remove stand from transmission.

- (4) Remove engine lifting fixture and install carburetor and lines.
- (6) Install vacuum lines, distributor cap and wiring.
- (7) Install exhaust pipe.
- (8) Connect carburetor linkage and wiring to engine.
- (9) Install radiator, radiator hoses and heater hoses.
- (10) Install fan shroud in position. Fill cooling system full.
- (11) Install battery and carburetor air cleaner. Connect vacuum hose, power steering hoses, if so equipped.
- (12) Install air conditioning equipment and charge air conditioning. Refer to Group 24 Air Conditioning for service.

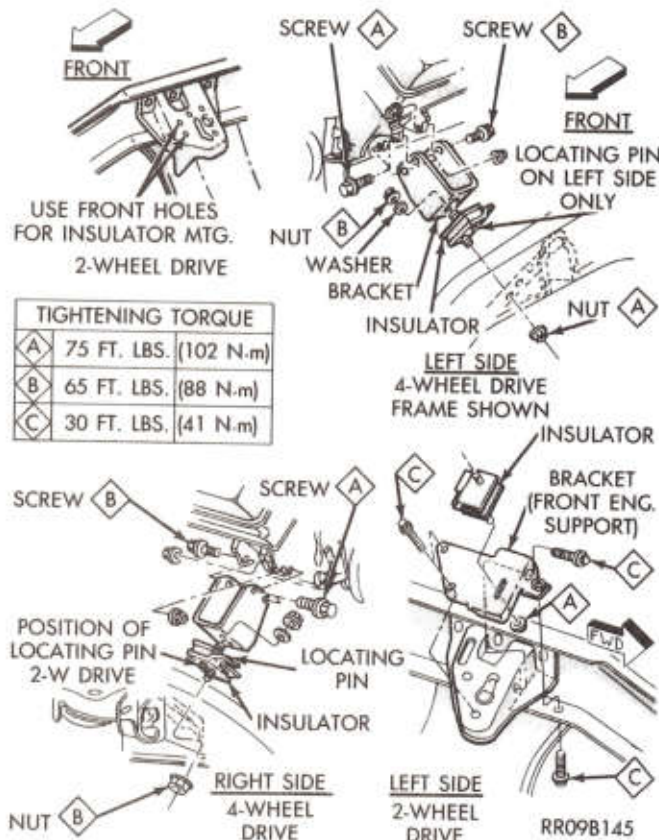


Fig. 1—Engine Mounts, Front, 8 Cylinder Engines

- (13) Warm engine and adjust.
- (14) Install hood and line up.
- (15) Road test vehicle.

ENGINE FRONT MOUNTS (Fig. 1)

Removal

- (1) Raise hood and position fan to assure clearance for radiator top tank and hose.
- (2) Raise vehicle on hoist.
- (3) Install engine lifting fixture Tool C-3487-A, with adapter rods DD-2179.
- (4) Remove nuts from brackets and insulators. (Fig. 1).
- (5) Raise engine with lifting fixture only far enough to remove mounts.

Installation

- (1) With engine raised **slightly**, install insulators and brackets.
- (2) Lower engine with lifting fixture while guiding insulator studs into attaching holes in crossmember and brackets.
- (3) Tighten attaching nuts and bolts to specified torques. (See Fig. 1).
- (4) Remove lifting fixture.

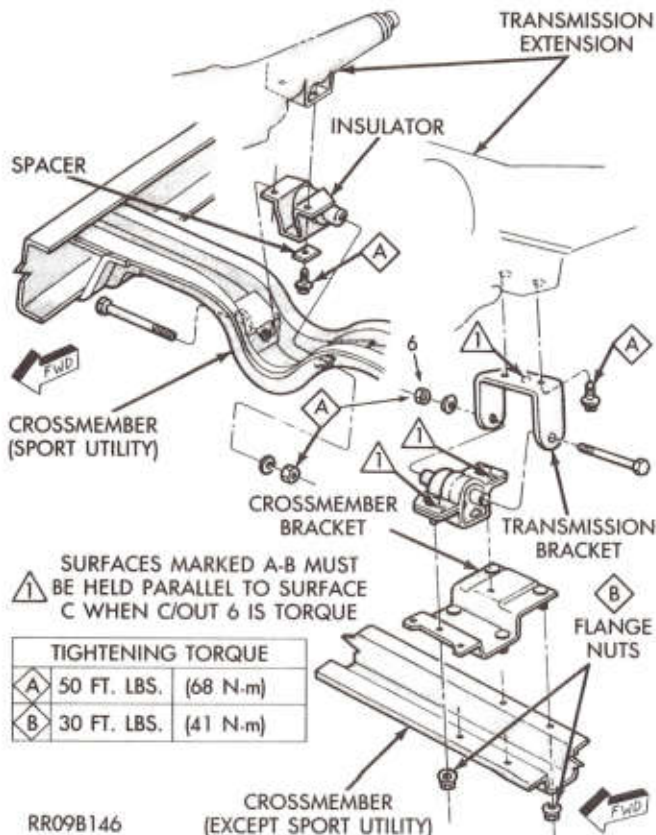


Fig. 2—Engine Mount, Rear

ENGINE REAR SUPPORT (Figs. 2 and 3)

Removal

- (1) With vehicle on hoist, position transmission jack and raise rear of transmission and engine **slightly**.
- (2) Remove rear mount through-bolt from frame crossmember or bracket. (Fig. 2).
- (3) Remove insulator from bottom face of transmission extension housing (sport utility) or from crossmember bracket, (except sport utility).

Installation

- (1) Install insulator on transmission extension housing; torque screws to 50 ft. lb. (68 N-m).
- (2) Install through bolt through crossmember and mount or through bracket and mount. Torque bolts to specifications. (Fig. 2).
- (3) Remove transmission jack.

ENGINE REAR MOUNTS

Four Wheel Drive

- (1) Raise vehicle on hoist and (if equipped with skid plate (Fig. 4) remove 4 bolts attaching skid plate rear crossmember to under side of frame.
- (2) Remove 5 bolts attaching front end of skid plate to transmission crossmember. Remove skid plate.
- (3) Position transmission jack under transmission and raise rear of transmission and engine **slightly**.
- (4) Remove mounting bolts and insulators, as shown in (Fig. 3).

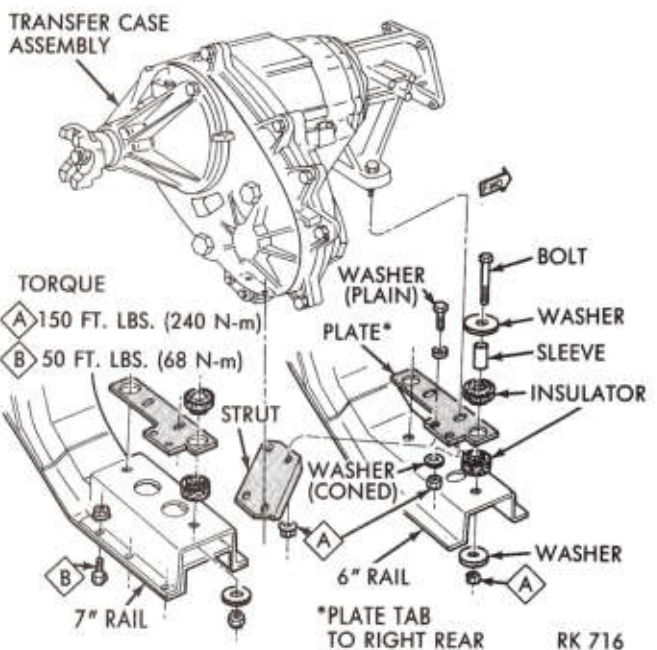


Fig. 3—Engine Mounts, Rear, Four-Wheel-Drive

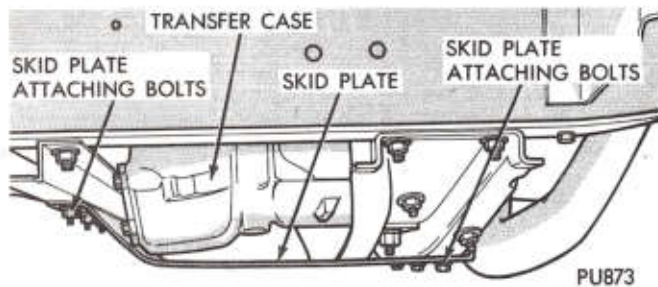


Fig. 4—Skid Plate

Installation

- (1) Install insulators and mounting bolts, as shown in (Fig. 3).
- (2) Install skid plate and lower vehicle to floor.

ENGINE ASSEMBLY**Checking Operation of Exhaust Valve Rotators (if so equipped)**

Before an engine is disassembled for valve grinding or major repair work, the performance of the exhaust valve rotators, if so equipped, should be checked.

- (1) With engine in vehicle, remove cylinder head covers.
- (2) Observe exhaust valve rotation with the engine running at 2000 and 3000 rpm the valve should rotate at uniform and constant speeds, (direction of rotation is not important). There is generally a large difference in rotation speeds between 1000 and 3000 rpm.
- (3) Rotators which do not appear to function properly should be replaced.

ROCKER ARMS AND SHAFT ASSEMBLY**Removal**

- (1) Disconnect spark plug wires by pulling on the boot straight out in line with plug.
- (2) Disconnect closed ventilation system and evaporation control system from cylinder head cover.
- (3) Remove cylinder head cover and gasket.
- (4) Remove five rocker shaft bolts and retainers.
- (5) Remove rocker arms and shaft assembly.
- (6) If rocker arm assemblies are disassembled for cleaning or replacement, refer to (Fig. 5) for rocker arm identification, and (Fig. 6) for positioning on the shaft.
- (7) On engines with exhaust valve rotators, exhaust rocker arm must have relief for clearance. Refer to (Fig. 5).

Installation

- (1) Install rocker arm and shaft assemblies with "Notch" on end of rocker shaft pointing to centerline of engine and toward front of engine on the left bank

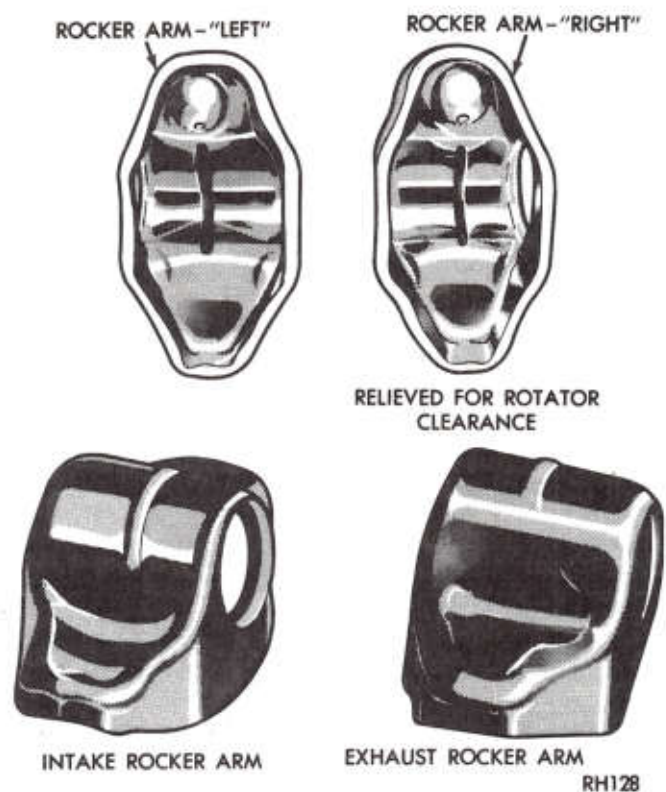


Fig. 5—Intake and Exhaust Rocker Arm Identification

and to the rear on right bank, making sure to install the long stamped steel retainers in the number two and four positions, tighten to 200 in. lb. (23 N-m) (Fig. 6).

WARNING: THE ROCKER ARM SHAFT SHOULD BE TORQUED DOWN SLOWLY, STARTING WITH THE CENTERMOST BOLTS. ALLOW 20 MINUTES TAPPET BLEED DOWN TIME, AFTER INSTALLATION OF THE ROCKER SHAFTS, BEFORE ENGINE OPERATION.

- (2) Clean cylinder head cover gasket surface. Inspect cover for distortion and straighten if necessary.
 - (3) Clean head rail if necessary. Install cylinder head cover and tighten to 80 in. lb. (9 N-m).
- Whenever the cylinder head cover gasket flange has

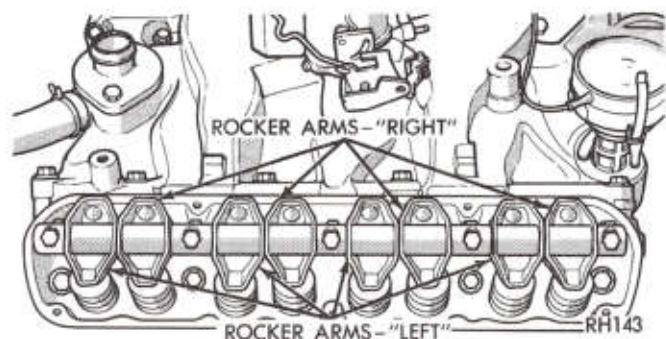


Fig. 6—Proper Rocker Arm Location on Shaft

been reworked, it may be necessary to install load spreader washers.

Make sure that the load spreader washers are so positioned that they will fit free when the cover attaching screws are tightened as specified.

If any interference is noticed between the load spreader washer and the cover, remove screw and washer. Reposition the washer to eliminate the interference. Install screw and tighten as specified.

(4) Install closed crankcase ventilation system and evaporation control system.

CYLINDER HEADS

The alloy cast iron cylinder heads shown in (Fig. 7) are held in place by 10 bolts. The spark plugs are located in peak of the wedge between the valves.

Removal

(1) Drain cooling system and disconnect battery ground cable.

(2) Remove alternator, carburetor air cleaner and fuel line.

(3) Disconnect accelerator linkage.

(4) Remove vacuum control hose between carburetor and distributor.

(5) Remove distributor cap and wires.

(6) Disconnect coil wires, heat indicator sending unit wire, heater hoses and by-pass hose.

(7) Remove closed ventilation system, evaporation control system and cylinder head covers.

(8) Remove intake manifold, ignition coil and carburetor as an assembly.

(9) Remove exhaust manifolds.

(10) Remove rocker arm and shaft assemblies. Remove push rods and **identify to insure installation in original locations.**

(11) Remove the 10 head bolts from each cylinder head and remove cylinder heads.

(12) Place cylinder heads in holding fixture Tool C-3626. Remove spark plugs.

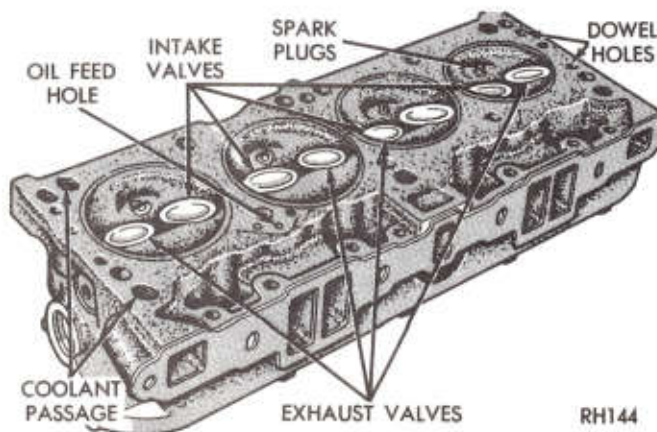


Fig. 7—Cylinder Head Assembly (Typical)

Installation

(1) Clean all surfaces of cylinder block and cylinder heads.

(2) Inspect all surfaces with a straightedge if there is any reason to suspect leakage. If out of flatness exceeds .00075 inch times the span length in inches in any direction, either replace head or lightly machine the head surface. As an example, if a 12 inch span is .004 inch out of flat, allowable is $12 \times .00075$ equals .009 inch. This amount of out of flat is acceptable.

The cylinder head surface finish should be 70-180 micro-inches.

(3) Coat new gaskets lightly with number 1057794 Sealer and install on cylinder block.

(4) Remove cylinder heads from holding fixtures and place heads on engine.

(5) On 8 cylinder engines bolt thread sealer is not required. Starting at top center, tighten all cylinder head bolts to 50 ft. lbs (68 N·m) in sequence shown in Figure 8. Repeat procedure, retighten all cylinder head bolts to 105 ft. lbs. (143 N·m).

(6) Inspect push rods and replace worn or bent rods.

(7) Install push rods, rocker arm and shaft assemblies with the "NOTCH" on the end of rockershaft pointing to center line of engine and toward front of engine on the left bank and to the rear on right bank, making sure to install the long stamped steel retainers in the number two and four positions, tighten to 200 in. lb. (23 N·m).

Intake Manifold (Sealing)

The 318 engine intake manifold is water cooled and requires "Right" and "Left" side gaskets. These steel embossed gaskets while providing conventional sealing also provide metered coolant flow. Cutouts at top front of each gasket (LT for left side and RT for right side) identified each gasket position (Fig. 9). The 360 engine intake manifold gaskets are composition material.

(8) On 318 engines, lightly coat the **STEEL** intake manifold side gaskets with sealer, Part Number

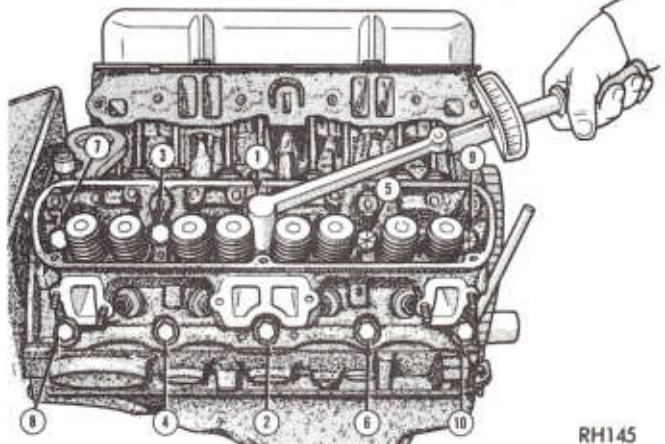


Fig. 8—Cylinder Head Bolt Tightening Sequence

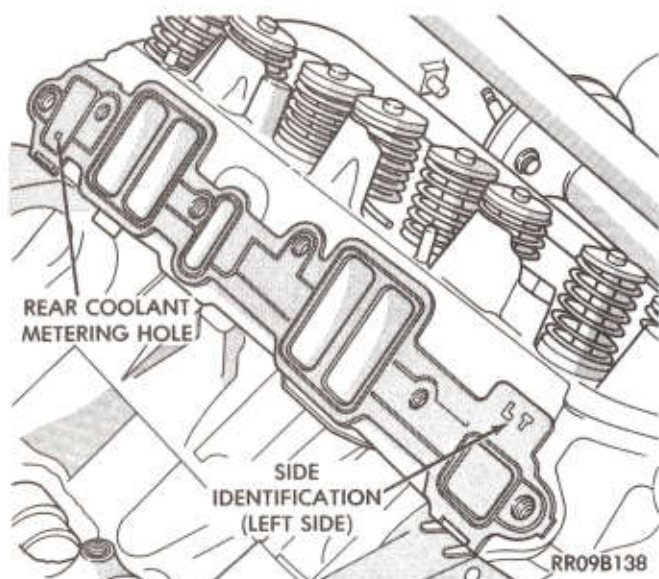


Fig. 9—318 Engine Intake Manifold Side Gaskets—Left Side Shown

4310835 or equivalent. On 360 engines, **DO NOT USE ANY SEALER ON SIDE COMPOSITION GASKETS.**

- (9) Install side gaskets to cylinder head.
- (10) Clean cylinder block front and rear gasket surfaces using a suitable solvent (Fig. 9).
- (11) Apply a thin, uniform coating of a quick dry cement to the intake manifold front and rear gaskets and cylinder block gasket surface. Allow to dry 4 to 5 minutes or until tack free.

When installing gaskets, the center hole in the gasket MUST engage dowels in block. End holes in seals MUST be locked into tangs of head gasket. (Fig. 10).

- (12) Carefully install the front and rear intake manifold gaskets.

(13) Place a drop (approximately 1/4" diameter) of rubber sealer Part Number 4026070 or equivalent, onto each of the **four** manifold to cylinder head gasket corners.

(14) Carefully lower intake manifold into position on the cylinder block and cylinder heads. After intake manifold is in place, **inspect to make sure seals are in place.**

(15) Install the twelve attaching cap screws "Finger Tight." Tighten cap screws one through four to 25 ft. lb. (34 N·m) and tighten remaining cap screws to 25 ft. lb. (34 N·m) in the tightening sequence shown in (Fig. 10) then retighten cap screws one through four to 40 ft. lb. (54 N·m) and follow by retightening the remaining cap screws to 40 ft. lb. (54 N·m) in sequence shown. (Fig. 11).

(16) Install exhaust manifolds and tighten screws to 20 ft. lb. (27 N·m) and nuts to 15 ft. lbs. (20 N·m).

(17) Adjust spark plugs to specifications in Electrical Section, "Group 8" and install the plugs.

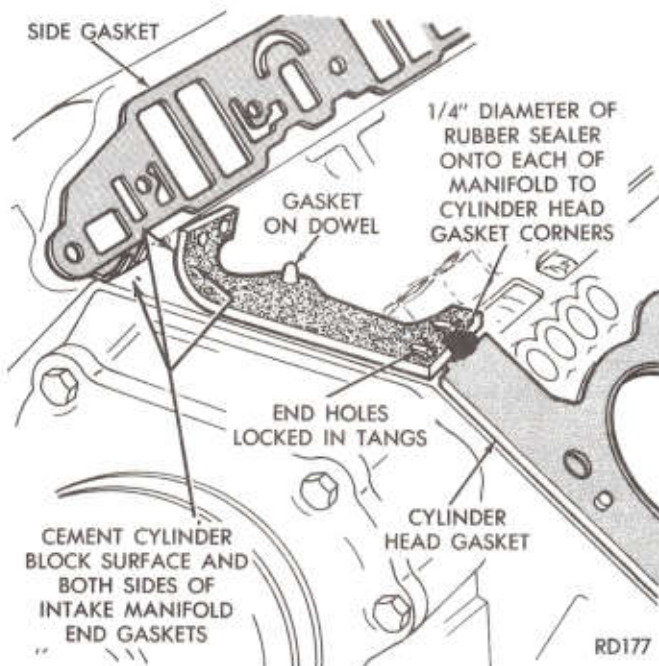


Fig. 10—Intake Manifold Sealing

- (18) Install coil wires, heat indicator sending unit wire, heater hoses and by-pass hose.
- (19) Install vacuum control hose between carburetor and distributor.
- (20) Install throttle linkage and adjust as necessary.
- (21) Install distributor cap and wires.
- (22) Install fuel lines, alternator and drive belt. Tighten alternator mounting bolt to 30 ft. lb. (41 N·m) and adjusting strap bolt to 200 in. lb. (23 N·m). See Cooling Section on adjusting belt tension.
- (23) Place new cylinder head cover gaskets in position and install cylinder head covers. Tighten to 95 in. lb. (11 N·m) using load spreader fasteners.
- (24) Install closed crankcase ventilation system and evaporation control system.

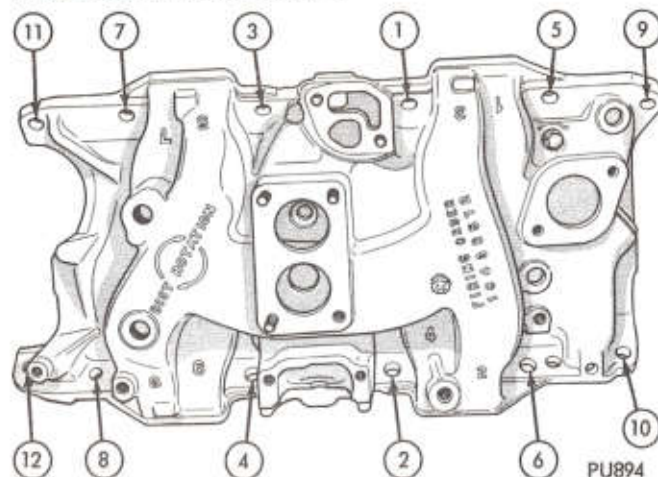


Fig. 11—Intake Manifold Screw Tightening Sequence (Typical)

(25) Fill cooling system and install battery ground cable.

VALVES AND VALVE SPRINGS

The valves are arranged in line in the cylinder heads and inclined 18 degrees. The rocker shaft support and the valve guides are cast integral with the heads.

Removal

- (1) With cylinder head removed, compress valve springs using Tool C-3422-A, as shown in (Fig. 12).
- (2) Remove valve retaining locks, valve spring retainers, valve stem cup seals and valve springs.
- (3) Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.

Valve Inspection

- (1) Clean valves thoroughly and discard burned, warped and cracked valves.
- (2) Measure valve stems for wear. New stem diameters should measure:

Intake372 to .373 inch (9.449 to 9.474mm).
 Exhaust371 to .372 inch (9.423 to 9.449mm).
 If wear exceeds .002 inch, replace valve.

- (3) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
- (4) Measure valve stem guide clearance as follows:
 - (a) Install sleeve Tool C-3973 over valve stem (Fig. 13) and install valve. The special sleeve places the valve at the correct height for checking with a dial indicator.
 - (b) Attach dial indicator Tool C-3339 to cylinder

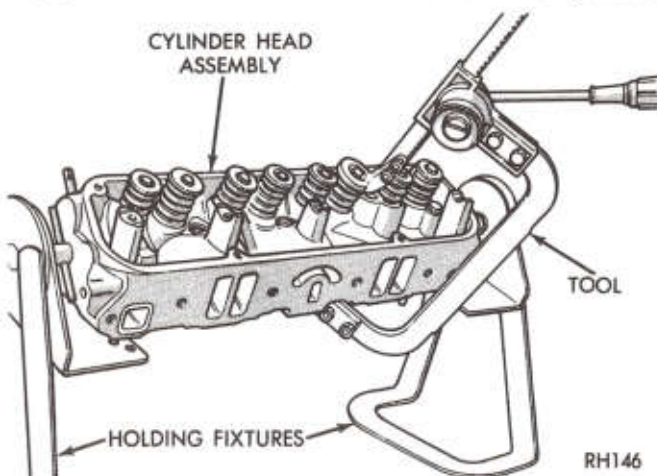


Fig. 12—Compressing Valve Spring with Tool C-3422A

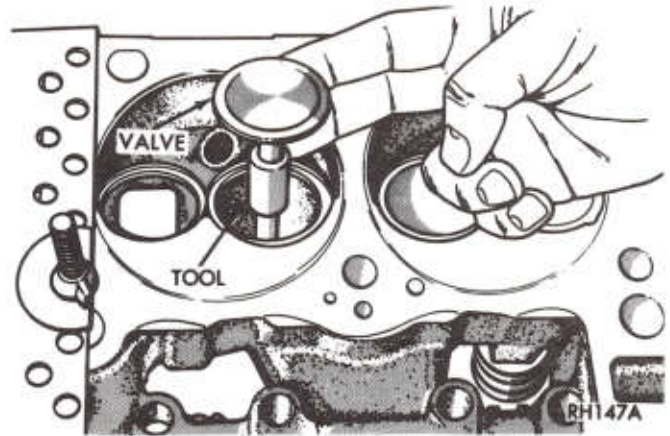


Fig. 13—Position Valve with Tool C-3973

head and set it at right angle of valve stem being measured (Fig. 14).

(c) Move valve to and from the indicator. The total dial indicator reading should not exceed .017 (.432mm) inch. Ream the guides for valves with oversize stems if dial indicator reading is excessive or if the stems are scuffed or scored.

(5) Service valves with oversize stems are available in .005 (.127mm), .015 (.381mm) and .030 (.762mm) inch oversize. Reamers to accommodate the oversize valve stem are as follows:

Reamer Tool Number	Reamer Oversize	Valve Guide Size
C-3433	.005 in.	.379-.380 in.
C-3430	.015 in.	.389-.390 in.
C-3427	.030 in.	.404-.405 in.

(6) Slowly turn reamer by hand and clean guide thoroughly before installing new valve. **Do not attempt to ream the valve guides from standard directly to .030 inch. Use step procedure of .005, .015 and .030 inch so the valve guides may be reamed true in relation to the valve seat.**

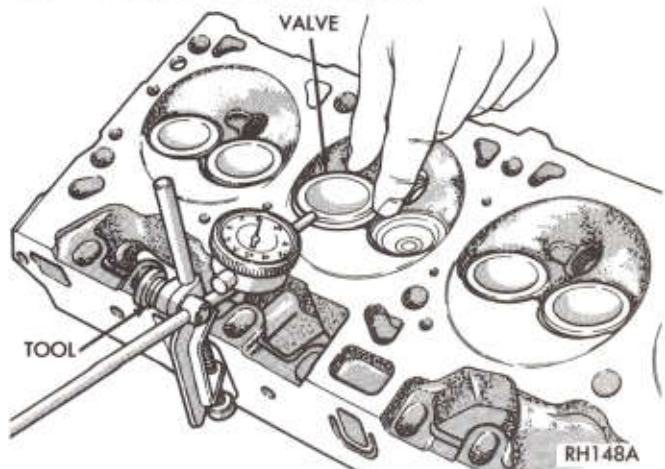
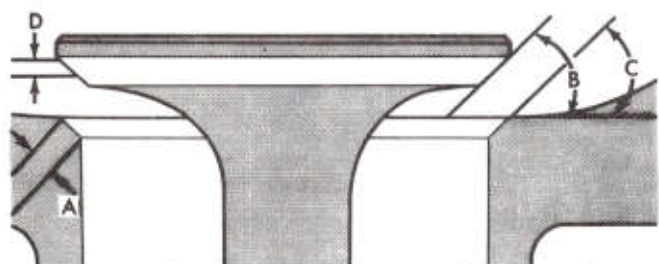


Fig. 14—Measuring Valve Guide Wear



A-SEAT WIDTH (INTAKE 1/16 (1.587 mm) TO 3/32 (2.381 mm) INCH
EXHAUST: (.080-.100 INCH) - (2-2.5 mm)
B-FACE ANGLE (INTAKE & EXHAUST: 44½°-45°)
C-SEAT ANGLE (INTAKE & EXHAUST: 45°-45½°)
D-CONTACT SURFACE

PU605

Fig. 15—Valve Face and Seat Angles

Refacing Valves and Valve Seats

The intake and exhaust valve seats and intake valve face have a 45 degree angle. The exhaust valve face has a 43 degree angle. The valve face and valve seat angles are shown in (Fig. 15).

Valves

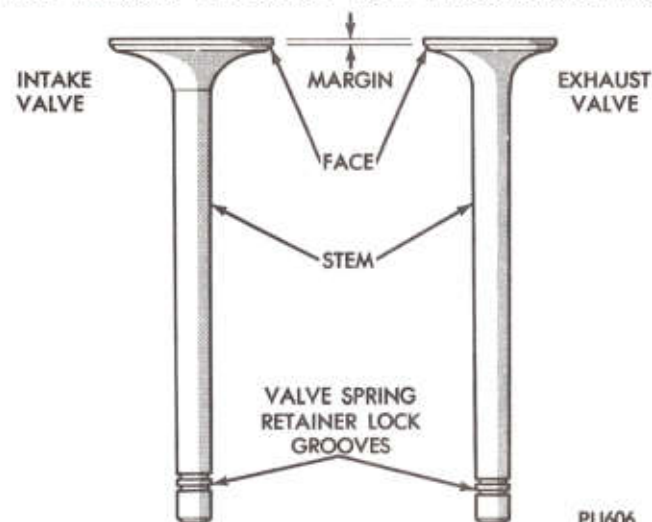
Inspect the remaining margin after the valves are refaced (Fig. 16). Valves with less than 3/64 (1.190mm) margin should be discarded.

Valve Seats

CAUTION: 318 C.I.D. (5.2L) engine cylinder head combustion chambers have been modified by valve shrouding. Do not un-shroud valves during valve seat refacing (Fig. 17).

(1) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

(2) Measure the concentricity of valve seat using dial indicator No. 13725. Total runout should not



PU606

Fig. 16—Intake and Exhaust Valves (Typical)

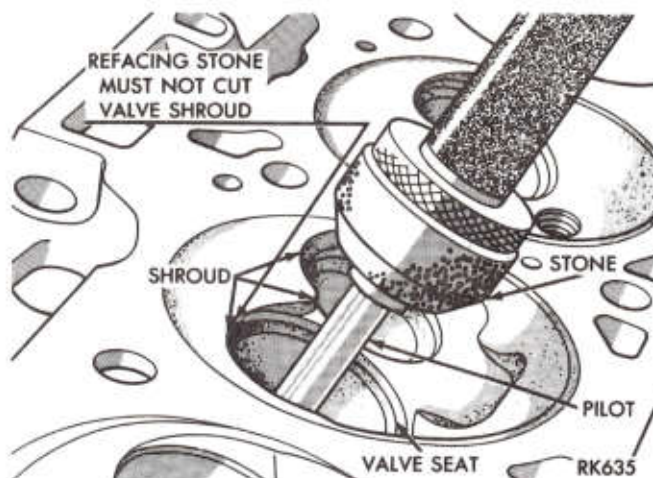


Fig. 17—Refacing 318 Engine Valve Seats

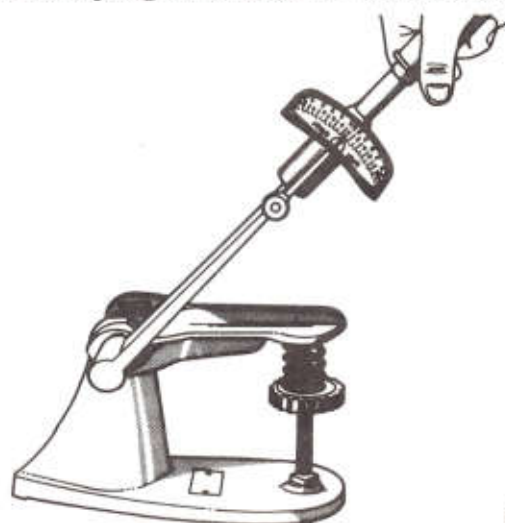
exceed .002 (.051mm) (total indicator reading).

(3) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to bottom edge of valve face raise valve seat with a 60 degrees stone.

(4) When seat is properly positioned the width of intake seats should be 1/16 to 3/32 inch (1.587 to 2.381mm). The width of the exhaust seats should be .080-.100 inch (2-2.5mm).

Testing Valve Springs (Fig. 18)

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested. As an example the compression length of the spring to be tested is 1-5/16 inches. Turn



RF259

Fig. 18—Testing Valve Spring for Compressed Length with Tool C-647

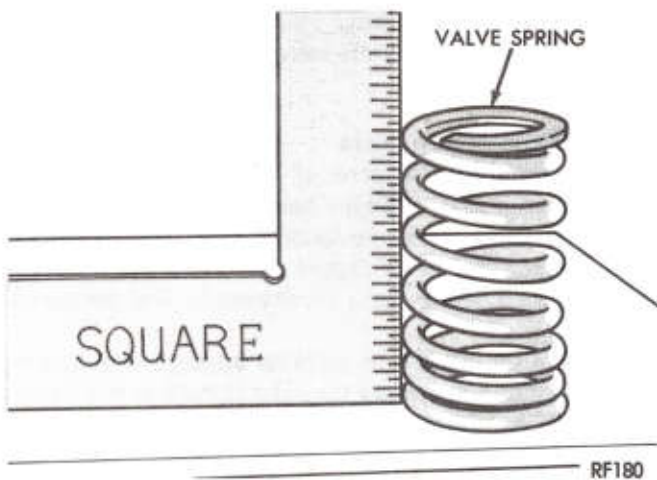


Fig. 19—Checking Valve Spring for Squareness

table of Tool C-647 until surface is in line with the 1-5/16 inch mark on the threaded stud and the zero mark to the front. Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to specifications to obtain specified height and allowable tensions. Discard the springs that do not meet specifications.

(2) Inspect each valve spring for squareness with a steel square and surface plate, test springs from both ends (Fig. 19).

If the spring is more than 5/64 inch (1.984mm) out of square, install a new spring.

Installation

Installing the wrong exhaust valve spring in engines with positive rotators can cause severe en-

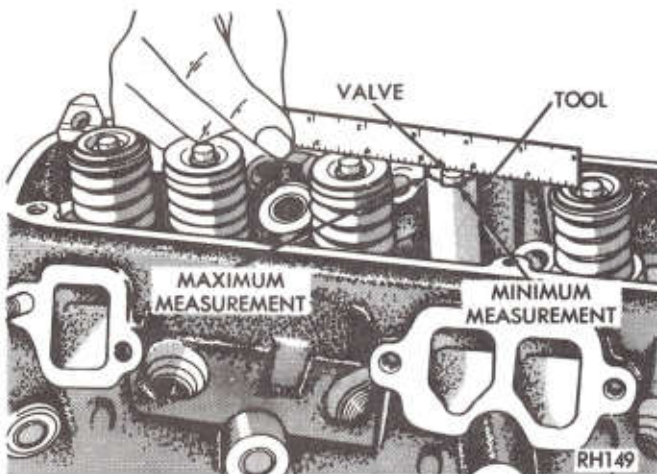


Fig. 20—Measuring Valve Stem Length with Tool C-396B

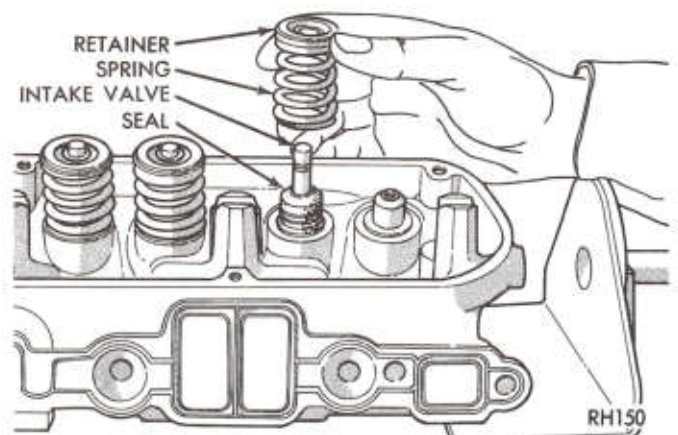


Fig. 21—Installing Valve, Cup Seal, Spring, and Retainer

gine damage. Refer to specifications for proper identification.

(1) Coat valve stems with lubrication oil and insert them in cylinder head.

(2) If valves or seats are reground, check valve stem height with Tool C-3968 (Fig. 20). If valve is too long, grind off the tip until length is within limits.

If engine is equipped with rotators, do not grind valve stem tip.

(3) Install new cup seals on all valve stems and over valve guides (Fig. 21). Install valve springs and valve retainers.

(4) Compress valve springs with Tool C-3422-A, install locks and release tool. **If valves and/or seats are reground, measure the installed height of springs, make sure measurement is taken from bottom of spring seat in cylinder head to the bottom surface of spring retainer (if spacers are installed, measure from the top of spacer).** If height is greater than 1-11/16 inches, (42.86mm), install a 1/16 inch (1.587mm) spacer in head counterbore to bring spring height back to normal 1-5/8 to 1-11/16 inch (41.27 to 42.86mm). Exhaust valve springs with positive rotators should have a length of 1.45-1.51 inch (36.8-38.1mm) when the valve is closed.

Replacing Valve Stem Shields or Valve Springs, Cylinder Head Not Removed

(1) Set engine basic timing to TDC and remove Air Cleaner.

(2) Remove cylinder head covers and spark plugs.

(3) Remove coil wire from distributor and secure to good ground to prevent engine from starting.

(4) Using suitable socket and flex handle at crankshaft pulley retaining screw, turn engine so the number 1 piston is at Top Dead Center on the compression stroke.

(5) Remove rocker arms with rocker shaft and install a dummy shaft. (The rocker arms should not be disturbed and left on shaft).

(6) With air hose attached to adapter tool C-3907 installed in number 1 spark plug hole, apply 90 to 100 psi air pressure (620.5 to 689 kPa).

(7) Using Tool C-3906 or C-4228 compress valve spring and remove retainer valve locks and valve spring.

(8) Install cup shields on the exhaust valve stem and position down against valve guides.

(9) The intake valve stem seals should be pushed firmly and squarely over the valve guide using the valve stem as a guide. **Do Not Force** seal against top of guide. When installing the valve retainer locks, compress the spring **only enough** to install the locks.

(10) Follow the same procedure on the remaining 7 cylinders using the firing sequence 1-8-4-3-6-5-7-2. **Make sure piston in cylinder is at TDC on the valve spring that is being removed.**

(11) Remove adapter Tool 3907.

(12) Remove dummy shaft and install rocker shaft with rocker arms.

(13) Install covers and coil wire to distributor.

(14) Install air cleaner.

(15) Road test vehicle.

HYDRAULIC TAPPETS

Preliminary to Checking the Hydraulic Tappets

Before disassembling any part of the engine to correct tappet noise, read the oil pressure at the gauge (Install a reliable gauge at pressure sending unit if vehicle has no oil pressure gauge) and check the oil level in the oil pan. The pressure should be between 30 and 80 pounds (207 to 552 kPa) at 3000 rpm.

The oil level in the pan should never be above the "full" mark on dipstick, or below the "add oil" mark. Either of these two conditions could be responsible for noisy tappets.

Oil Level Too High

If oil level is above the "full" mark on dipstick, it is possible for the connecting rods to dip into the oil while engine is running and create foam. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to lose length and allow valves to seat noisily.

Oil Level Too Low

Low oil level may allow the oil pump to take in air which when fed to the tappets, causes them to lose length and allows valves to seat noisily. Any leaks on intake side of oil pump through which air can be drawn will create the same tappet action. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than one tappet will be noisy. When oil level and leaks have been corrected,

engine should be operated at fast idle for sufficient time to allow all of the air inside of the tappets to be bled out.

Tappet Noise Diagnosis

(1) To determine source of tappet noise, operate engine at idle with cylinder head covers removed.

(2) Feel each valve spring or rocker arm to detect noisy tappet. The noisy tappet will cause the affected spring and/or rocker arm to vibrate or feel rough in operation.

Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

(3) Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leakdown around the unit plunger which will necessitate replacing the tappet, or by the plunger partially sticking in the tappet body cylinder. A heavy click is caused either by a tappet check valve not seating, or by foreign particles becoming wedged between the plunger and the tappet body, causing the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed for inspection and cleaning.

Tappet Removal

(1) Drain cooling system (partial) and remove air cleaner.

(2) Remove valve cover and rocker assembly and push rods and identify push rods to insure installation in original location.

(3) Remove upper radiator hose, heater hose and bypass hose from intake manifold.

(4) Remove distributor and intake manifold assembly.

(5) Remove tappets.

If all tappets are to be removed, **identify tappets to insure installation in original location.**

CAUTION: The plunger and tappet bodies are not interchangeable. The plunger and valve must always be fitted to the original body. It is advisable to work on one tappet at a time to avoid mixing of parts. Mixed parts are not compatible. Do not disassemble a tappet on a dirty work bench.

Disassembly (Fig. 22)

(1) Pry out plunger retainer spring clip.

(2) Clean varnish deposits from inside of tappet body above plunger cap.

(3) Invert tappet body and remove plunger cap,

plunger, flat or ball check valve, check valve spring, check valve retainer and plunger spring.

Cleaning and Assembly

- (1) Clean all tappet parts in a solvent that will remove all varnish and carbon.
- (2) Replace tappets that are unfit for further service with new assemblies.
- (3) If plunger shows signs of scoring or wear and valve is pitted, or if valve seat on end of plunger indicates any condition that would prevent valve from seating, install a new tappet assembly.
- (4) Assemble tappets (Fig. 22).

Installation

- (1) Lubricate tappets.
- (2) Install tappets and push rods in their original positions.
- (3) Install rocker arm and shaft assembly.
- (4) Clean all mating surfaces and install intake manifold with new gaskets.
- (5) Connect all hoses and refill cooling system.
- (6) Install valve cover.
- (7) Install distributor, start engine and reset timing.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic tappets have filled with oil and have become quiet.

VALVE TIMING

- (1) Turn crankshaft until the NO. 6 exhaust valve is closing and NO. 6 intake valve is opening.
- (2) Insert a 1/4 (6.350mm) inch spacer between rocker arm pad and stem tip of No. 1 intake valve. Allow spring load to bleed tappet down giving in effect a solid tappet.
- (3) Install a dial indicator so plunger contacts valve spring retainer as nearly perpendicular as possible. Zero the indicator.
- (4) Rotate the crankshaft clockwise (normal running direction) until the valve has lifted .010 (.254mm) inch for 318 cubic engines, .034 (.863mm) inch for 360

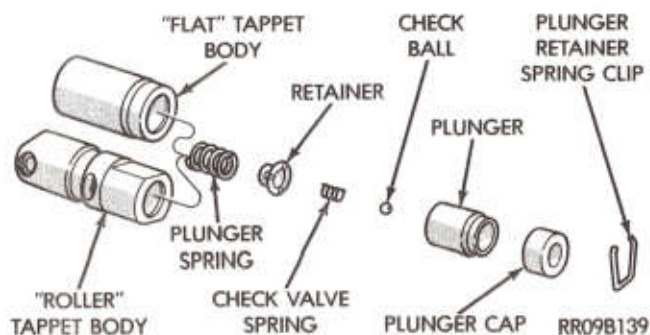


Fig. 22—Hydraulic Tappet Assemblies

cubic inch engine.

CAUTION: Do not turn crankshaft any further clockwise as valve spring might bottom and result in serious damage.

The timing of the crankshaft pulley should now read from 10 degrees before top dead center to 2 degrees after top dead center. Remove spacer.

- (5) If reading is not within specified limits:

- (a) Check sprocket index marks.
- (b) Inspect timing chain for wear.

- (c) Check accuracy of DC mark on timing indicator.

TIMING CHAIN COVER, OIL SEAL AND CHAIN

Cover Removal

- (1) Drain cooling system.
- (2) Refer to Cooling System Group 7 for procedure to remove water pump.
- (3) Remove power steering pump.
- (4) Remove pulley from vibration damper and bolt and washer securing vibration damper on crankshaft.
- (5) Install bar from Tool (C-3688) and screw from Tool (C-3732A) and pull vibration damper from end of crankshaft (Fig. 23).
- (6) Remove fuel lines and fuel pump.
- (7) Loosen oil pan bolts and remove the front bolt at each side.
- (8) Remove chain case cover and gasket using extreme caution to avoid damaging oil pan gasket.

Measuring Timing Chain for Stretch

- (1) Place a scale next to timing chain so that any movement of chain may be measured.
- (2) Place a torque wrench and socket over camshaft sprocket attaching bolt and apply torque in direction of crankshaft rotation to take up slack; 30 ft. lb. (41 N·m) (with cylinder head installed) or 15 ft. lb. (20 N·m) (cylinder heads removed). **With a torque applied to the camshaft sprocket bolt, crankshaft should not be permitted to move. It may be necessary to block crankshaft to prevent rotation.**

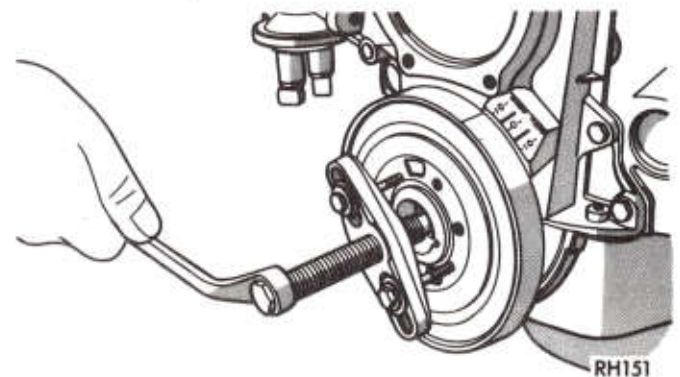


Fig. 23—Removing Vibration Damper Assembly

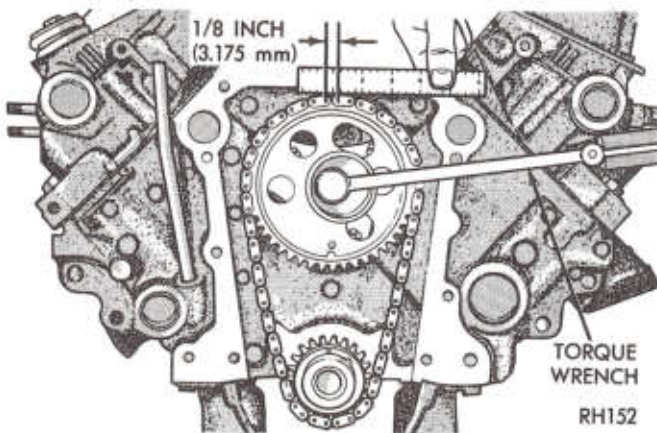


Fig. 24—Measuring Timing Chain Wear and Stretch

(3) Holding a scale with dimensional reading even with edge of a chain link, apply torque in the reverse direction 30 ft. lb. (14 N·m) (with cylinder heads installed) or 15 ft. lb. (20 N·m) (cylinder heads removed) and note amount of chain movement (Fig. 24).

(4) Install a new timing chain, if its movement exceeds 1/8 (3.175mm) inch.

(5) If chain is not satisfactory, remove camshaft sprocket attaching cup washer, fuel pump eccentric and remove timing chain with crankshaft and camshaft sprockets.

(6) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(7) Place timing chain around both sprockets.

(8) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

(9) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(10) Slide both sprockets evenly over their respective shafts and use a straight edge to check alignment of timing marks (Fig. 25).

(11) Install the fuel pump eccentric, cup washer,

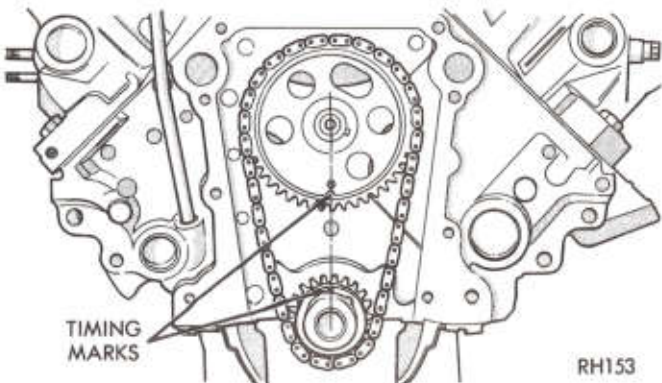


Fig. 25—Alignment of Timing Marks

and camshaft bolt. Tighten bolt to 35 foot pounds (47 N·m).

(12) Check camshaft for .002 to .006 inch (.051 to .0152mm) end play with a new thrust plate and up to .010 inch (.254mm) end play with a used thrust plate. If not within these limits install a new thrust plate.

TIMING CHAIN COVER EXTERNAL OIL SEAL

Removal

(1) Disconnect battery.

(2) Loosen and remove belts from crankshaft pulley.

(3) Remove radiator shroud retainer screws and set shroud back over engine.

(4) Remove fan and shroud from engine.

(5) Remove crankshaft pulley and vibration damper bolt and washer from end of crankshaft.

(6) Install bar from tool (C-3688) and screw from tool (C-3732A) and pull vibration damper from end of crankshaft. (Fig. 23).

(7) Using a suitable tool behind the lips of the oil seal pry outward, being careful not do damage the crankshaft seal surface of cover. (Fig. 26).

Installation

(1) Install new seal by installing the threaded shaft part of tool (C-4251) into the threads of the crankshaft.

(2) Place seal into opening with seal spring towards the inside of the engine.

(3) Place the installing adapter C-4251-3 with the thrust bearing and nut on the shaft. Tighten nut until tool is flush with the timing chain cover. (Fig. 27).

(4) Install vibration damper using tool C-3688 (Fig. 28).

(5) Install retainer bolt and washer and torque to 135 ft. lb. (183 N·m).

(6) Install pulley on vibration damper and torque to 200 in. lb. (23 N·m).

(7) Set radiator shroud back over engine and install fan and belts.

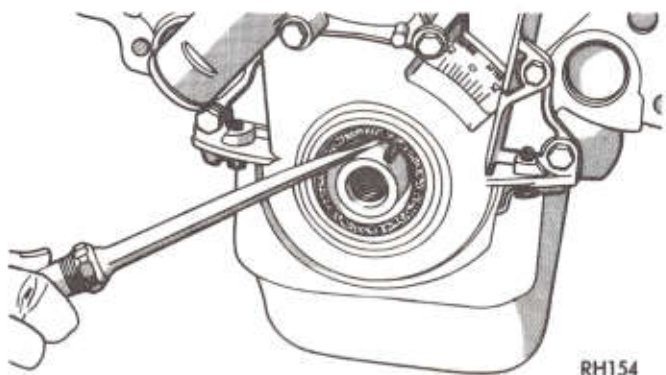


Fig. 26—Removing Oil Seal

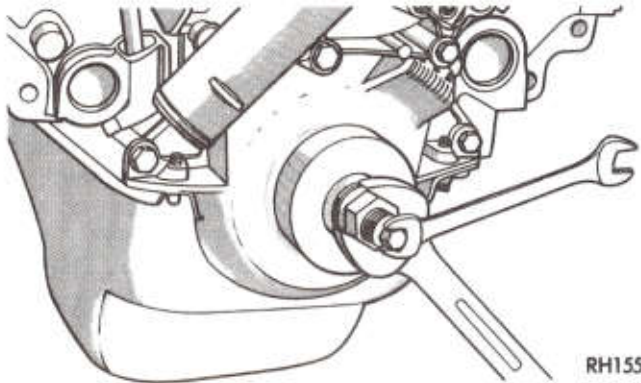


Fig. 27—Installing Oil Seal

- (8) Install radiator shroud to radiator.
- (9) Connect battery.

Cover Installation

- (1) Be sure mating surfaces of chain case cover and cylinder block are clean and free from burrs.
- (2) Using a new cover gasket, carefully install chain case cover to avoid damaging oil pan gasket. A 1/8 (3.175mm) inch diameter bead of RTV sealer (PN-4026070) or equivalent is recommended on the oil pan gasket. **Do not tighten screws at this time.**
- (3) Lubricate seal lip with lubriplate or equivalent. Position damper hub slot in crankshaft. Damper will act as a pilot for the crankshaft seal.
- (4) Place installing tool, part of Puller set Tool C-3688 in position and press vibration damper on crankshaft (Fig. 28).
- (5) Tighten chain case cover cap screws to 30 ft. lbs. (41 N·m) **first**. Then tighten oil pan cap screws to 200 in. lbs. (23 N·m).
- (6) Install vibration damper retainer bolt with washer and tighten to 135 ft. lb. (183 N·m).
- (7) Position pulley on vibration damper and attach with bolts and lockwashers. Tighten to 200 in. lb. (23 N·m).
- (8) Install fuel pump and fuel lines.
- (9) Install water pump and housing assembly using

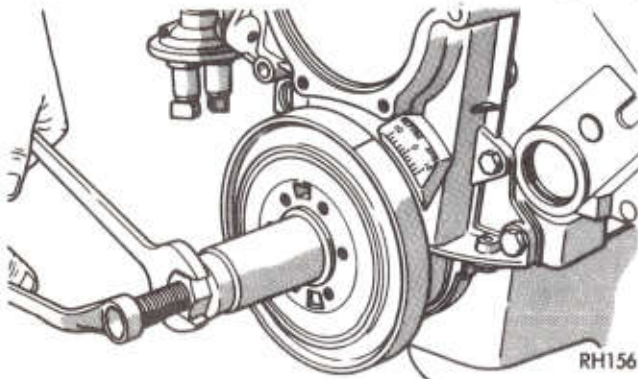


Fig. 28—Installing Vibration Damper with Tool C-3688

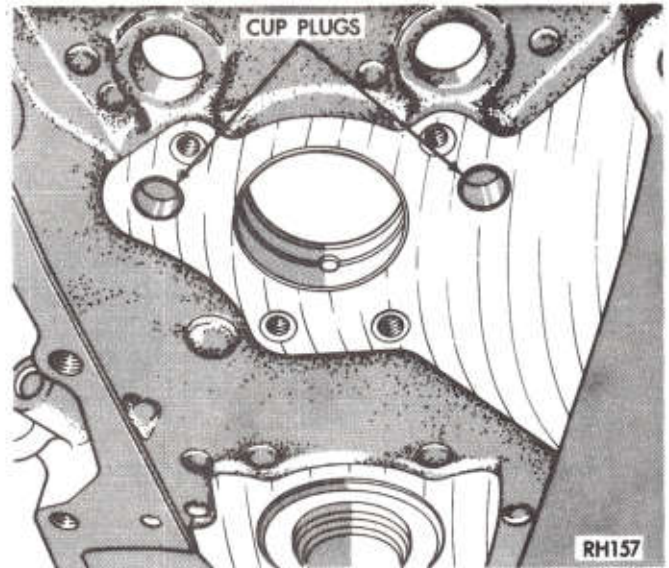


Fig. 29—Location of Cup Plugs in Oil Galleries

new gaskets. Tighten bolts to 30 ft. lb. (41 N·m).

- (10) Install power steering pump.
- (11) Install fan and belt, hoses and close drains.
- (12) Install radiator shroud.
- (13) Fill cooling system.

CAMSHAFT

(Engine Removed from Vehicle)

The camshaft has an integral oil pump and distributor drive gear and a bolt-on fuel pump eccentric, as shown in (Fig. 30). Remove intake manifold, cylinder head covers, timing case cover and timing chain.

- (1) Remove rocker arm and shaft assemblies.
- (2) Remove push rods and tappets; identify so each part will be replaced in its original location.
- (3) Remove distributor and lift out the oil pump and distributor drive shaft.
- (4) Remove camshaft thrust plate, **note location of oil tab (Fig. 32).**
- (5) Install a long bolt into front of camshaft to facilitate removal of the camshaft; remove camshaft, being careful not to damage cam bearings with the cam lobes.

To reduce internal leakage and help maintain

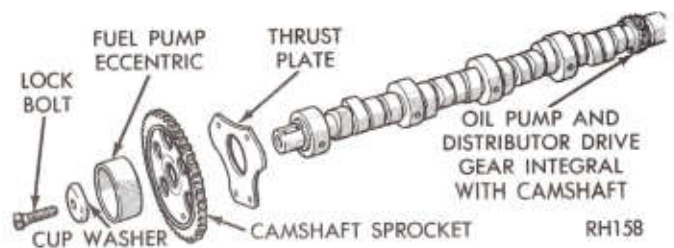


Fig. 30—Camshaft and Sprocket Assembly

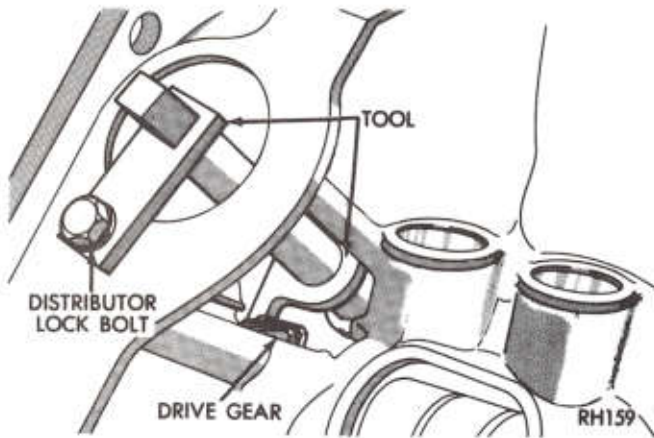


Fig. 31—Camshaft Holding Tool C-3509 in Installed Position

higher oil pressure at idle, cup plugs have been pressed into the oil galleries behind the camshaft thrust plate (Fig. 29).

Installation

(1) Lubricate camshaft lobes and camshaft bearing journals and insert the camshaft to within 2 inches of its final position in cylinder block.

Whenever an engine has been rebuilt and/or a new camshaft and/or new tappets have been installed, add one pint of Chrysler Crankcase Conditioner Part Number 3419130 or equivalent to engine oil to aid in break in. The oil mixture should be left in engine for a minimum of 500 (805km) miles, and drained at the next normal oil change.

(2) Install Tool C-3509 with tongue back of distributor drive gear (Fig. 31).

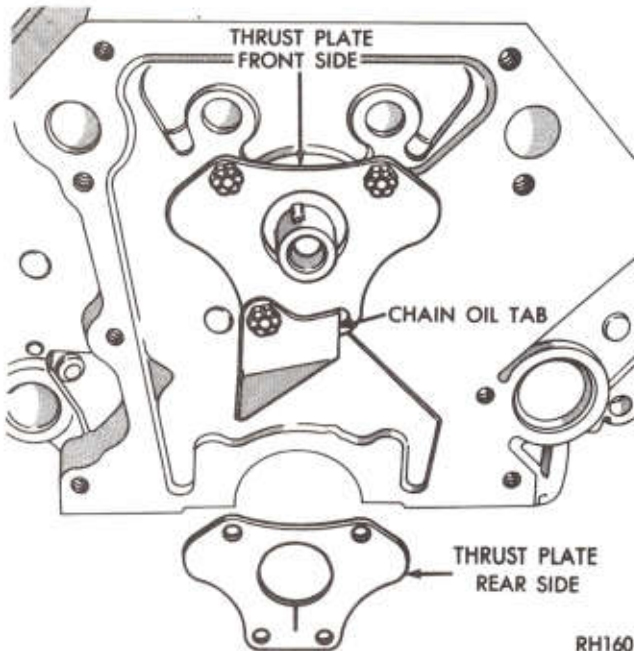


Fig. 32—Timing Chain Oil Tab Installation

(3) Hold tool in position with a distributor lock plate screw. This tool will restrict camshaft from being pushed in too far and prevent knocking out the welch plug in rear of cylinder block. **Tool should remain installed until the camshaft and crankshaft sprockets and timing chain have been installed.**

(4) Install camshaft thrust plate and chain oil tab, with three screws as shown in (Fig. 32). **Make sure tang enters lower right hole in thrust plate. Tighten to 210 in. lb. (24 N-m). Top edge of tab should be flat against thrust plate in order to catch oil for chain lubrication.**

(5) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(6) Place timing chain around both sprockets.

(7) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

(8) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(9) Slide both sprockets evenly over their respective shafts and use a straight edge to check alignment of timing marks (Fig. 33).

(10) Install the fuel pump eccentric, cup washer, and camshaft bolt. Tighten bolt to 35 ft. lb. (47 N-m).

(11) Measure camshaft end play. Refer to Specifications for proper clearance. If not within limits install a new thrust plate.

(12) Each tappet reused must be installed in the same position from which it was removed. Tappets must have a definite crown. **When camshaft is replaced, all of the tappets must be replaced.**

CAMSHAFT BEARINGS

(Engine Removed from Vehicle)

Removal

(1) With engine completely disassembled, drive out rear cam bearing core hole plug.

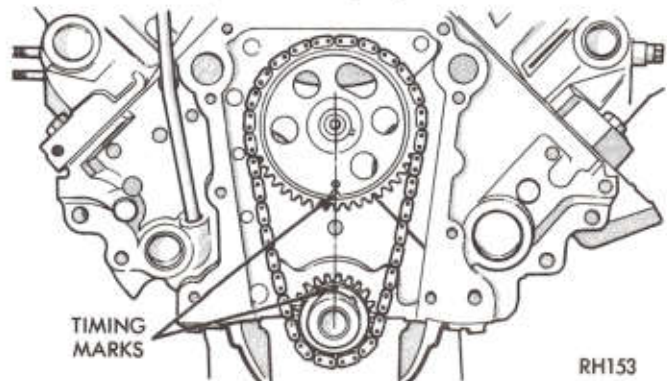


Fig. 33—Alignment of Timing Marks

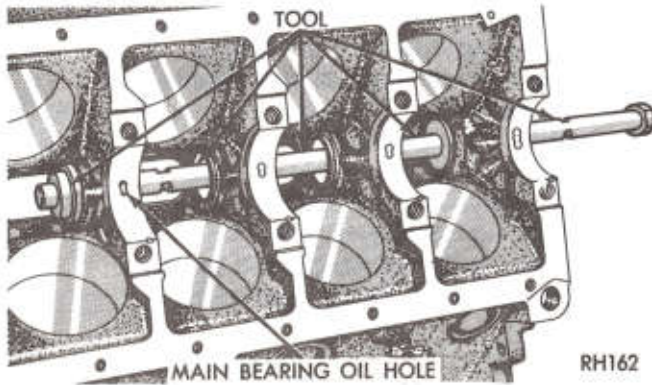


Fig. 34—Removal and Installation of Camshaft Bearings with Tool C-3132A

(2) Install proper size adapters and horse shoe washers (part of Tool C-3132-A) at back of each bearing shell to be removed and drive out bearing shells, (Fig. 34).

Installation

(1) Install new camshaft bearings with Tool C-3132-A by sliding the new camshaft bearing shell over proper adapter.

(2) Position rear bearing in the tool. Install horse-shoe lock and by reversing removal procedure, carefully drive bearing shell into place.

(3) Install remaining bearings in the same manner. Bearings must be carefully aligned to bring oil holes into full register with oil passages from the main bearing. Also, number two bearing must index with the oil passage to the left cylinder head and Number four bearing must index with the oil passage to the right cylinder head. If the camshaft bearing shell oil holes are not in exact alignment, remove and reinstall them correctly. Install a new core hole plug at the rear of camshaft. **Be sure this plug does not leak.**

DISTRIBUTOR DRIVE SHAFT BUSHING

Removal

(1) Insert Tool C-3052 into old bushing and thread

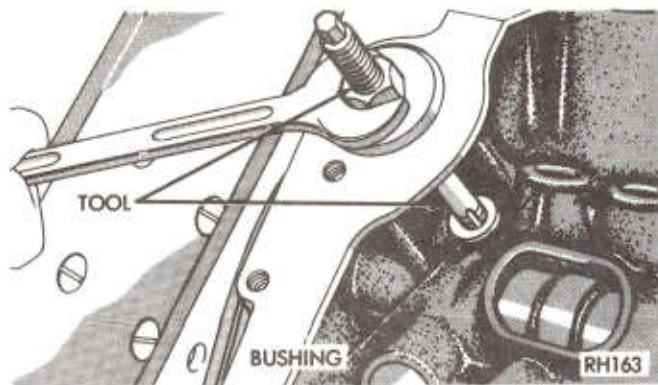


Fig. 35—Removing Distributor Drive Shaft Bushing with Tool C-3052

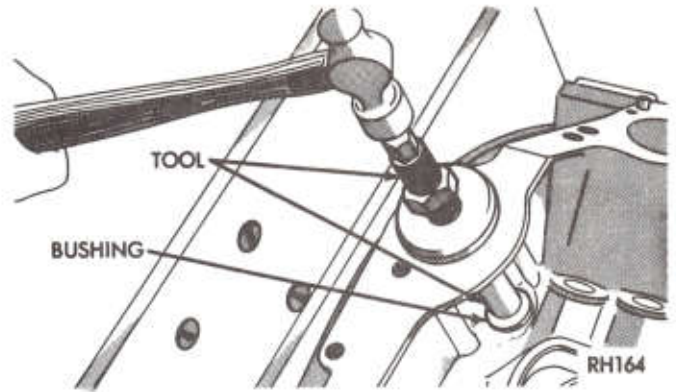


Fig. 36—Installing Distributor Drive Shaft Bushing with Tool C-3053

down until a tight fit is obtained (Fig. 35).

(2) Hold puller screw and tighten puller nut until bushing is removed.

Installation

(1) Slide new bushing over burnishing end of Tool C-3053 and insert the tool and bushing into the bore.

(2) Drive bushing and tool into position, using a hammer (Fig. 36).

(3) As the burnisher is pulled through the bushing by tightening the puller nut, the bushing is expanded tight in block and burnished to correct size, (Fig. 37).

Do not ream this bushing.

Distributor Timing

Before installing the distributor and oil pump drive shaft, time engine as follows:

(1) Rotate crankshaft until No. 1 cylinder is at top dead center on the firing stroke.

(2) When in this position, the timing mark on vibration damper should be under ("O") on the timing indicator.

(3) Coat shaft and drive gear with engine oil. Install the shaft so that after gear spirals into place, it will index with the oil pump shaft, so slot in top of drive

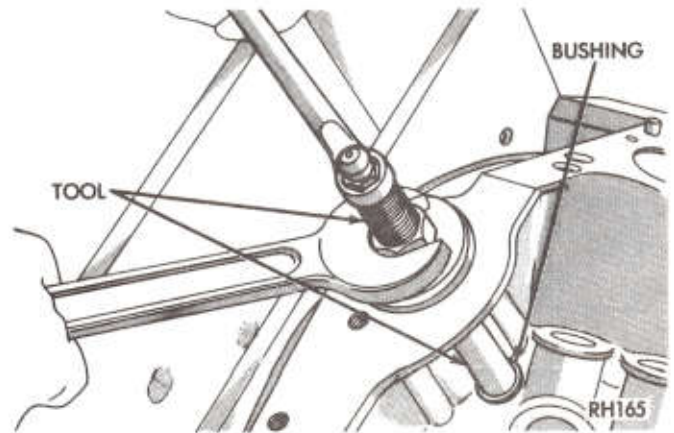


Fig. 37—Burnishing Distributor Drive Shaft Bushing

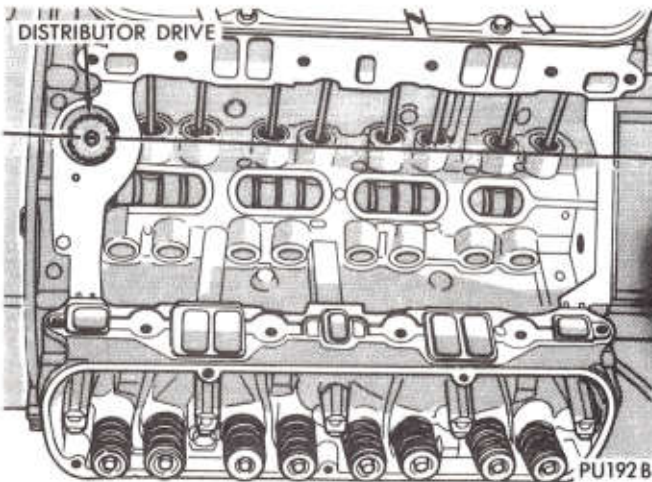


Fig. 38—Position of Installed Distributor Drive Gear

gear will point in a direction parallel to the center line of the crankshaft (Fig. 38).

Installation of Distributor

- (1) Hold the distributor over the mounting pad on cylinder block with vacuum chamber pointing toward right front of engine.
- (2) Turn rotor until it points forward and to approximate location of No. 1 tower terminal in distributor cap (Fig. 39).
- (3) Place distributor O-ring in position.
- (4) Lower the distributor and engage the shaft in the slot of distributor drive shaft gear.

CYLINDER BLOCK

Piston Removal

(1) Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation. Pistons and connecting rods must be removed from top of cylinder block. When**

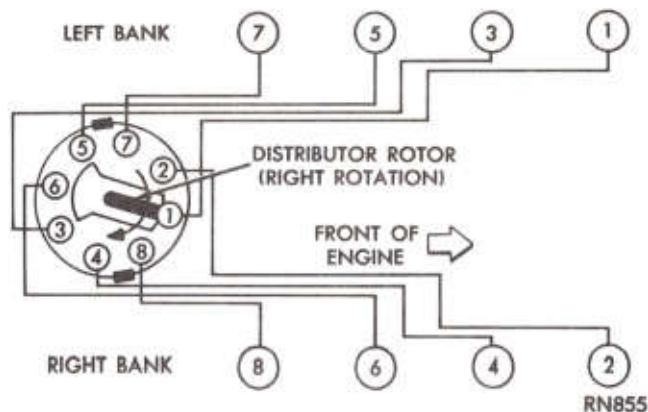


Fig. 39—Distributor with Rotor Positioned Under No. 1 Tower of Cap

removing piston and connecting rod assemblies from the engine, rotate crankshaft so that each connecting rod is centered in cylinder bore.

(2) Inspect connecting rods and connecting rod caps for cylinder identification. Identify them if necessary.

(3) Remove connecting rod cap. Install connecting rod bolt guide set on connecting rod bolts. Push each piston and rod assembly out of cylinder bore.

Be careful not to nick crankshaft journals.

(4) After removal, install bearing cap on the mating rod.

Cleaning and Inspection

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are installed, see "Engine Core Oil and Cam Plugs."

(3) Examine block for cracks or fractures.

Cylinder Bore Inspection

The cylinder walls should be checked for out-of-round and taper with Tool C-119. If the cylinder bores show more than .005 inch (.127mm) out-of-round, or a taper of more than .010 inch (.254mm) or if the cylinder walls are badly scuffed or scored, the cylinder block should be rebored and honed, and new pistons and rings fitted. Whatever type of boring equipment is used, boring and honing operation should be closely coordinated with the fitting of pistons and rings in order that specified clearances may be maintained.

ENGINE CORE OIL AND CAM PLUGS

Removal

Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup plug (Fig. 40). With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 40). **CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.**

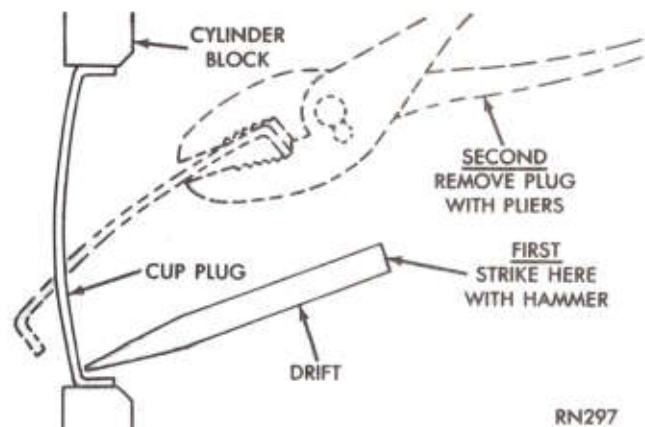


Fig. 40—Core Hole Plug

Installation

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Loctite (PN4057987) Stud N' Bearing Mount or equivalent. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least .02 in. (0.5mm) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

PISTONS, PINS AND RINGS

The pistons are cam ground so that the diameter at the pin boss is less than its diameter across the thrust face. This allows for expansion under normal operating conditions. Under operating temperatures, expansion forces the pin bosses away from each other, thus, causing the piston to assume a more nearly round shape. It is important that pistons be checked for taper and elliptical shape before they are fitted into the cylinder bore (Figs. 41 and 42).

Finished Pistons

All pistons are machined to the same weight in grams, regardless of oversize, to maintain piston balance. For cylinder bores which have been honed or rebored new pistons are furnished with fitted pins, available in standard and the following oversize: .020 inch (.508mm).

Fitting Pistons

Piston and cylinder wall must be clean and dry. Specified clearance between the piston and the cylinder wall is .0005 to .0015 inch (.0127 to .0381mm).

Piston diameter should be measured at the top of

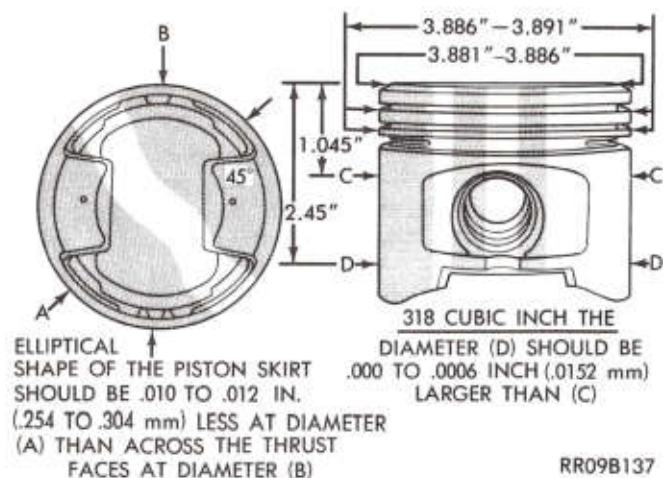


Fig. 41—Piston Measurements, 318 CID Engine

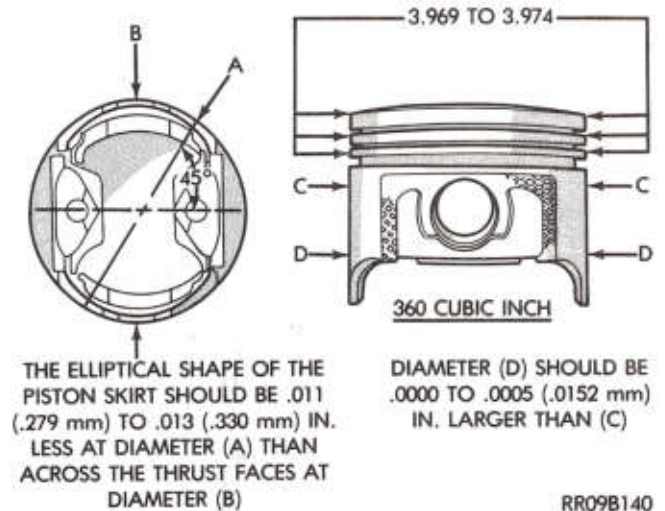


Fig. 42—Piston Measurements, 360 CID Engine

skirt 90 degrees to piston pin axis. Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line.

Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C).

PISTON PINS

On both the 318 and 360 cubic inch engines, the piston pin rotates in the piston only, and is retained by the press interference fit of the piston pin in the connecting rod.

Fitting Rings

(1) Measure piston ring gap about two inches from bottom of cylinder bore in which it is to be fitted (An inverted piston can be used to push the rings down to insure positioning rings squarely in the cylinder bore before measuring).

(2) Insert feeler stock in the gap. The ring gap should be between .010 and .020 inch (.254 and .508mm) for compression rings and .015 to .062 inch (.381 to 1.575mm) for oil ring steel rails in standard size bores (for new service rings). Maximum gap in .005 inch (.127mm) O/S bores should be .060 inch (1.524mm) for compression rings and .070 inch (1.778mm) for oil ring steel rails.

(3) Measure side clearance between piston ring and ring land (Fig. 43). Clearance should be .0015 to .003 inch (.038 to .076mm) for the top compression ring and the intermediate ring. Steel rail service oil ring should be free in groove, but should not exceed .005 inch (.127mm) side clearance.

(4) On both the 318 and 360 engines, the keys on the spacer expander must be inserted into the hole in the oil ring groove over the piston pin front boss. (Fig. 44).

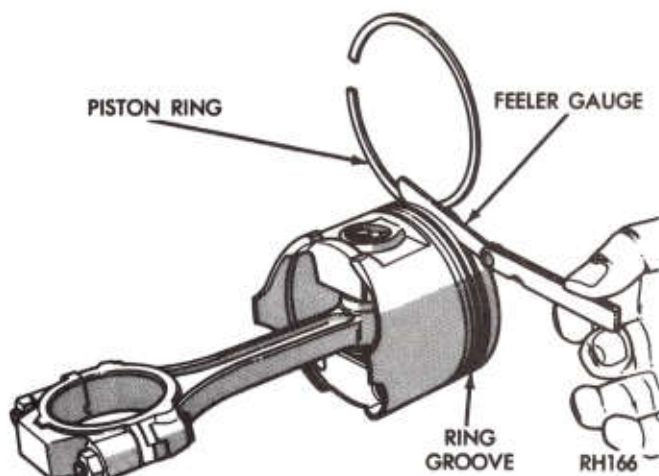
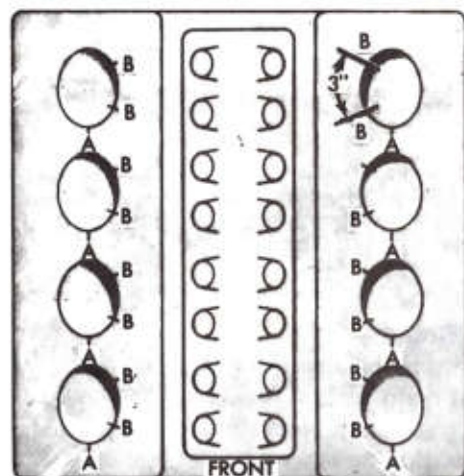


Fig. 43—Measuring Piston Ring Side Clearance

(5) Arrange oil ring rail gaps on inboard side of piston as shown at top of (Fig. 44).

(6) Install compression rings in middle and top grooves; use Ring Installer Tool C-3586 for 318 cubic



IF YOU HAVE FOLLOWED THE INSTRUCTIONS, THE RING WILL BE IN THIS POSITION ON THE PISTON.

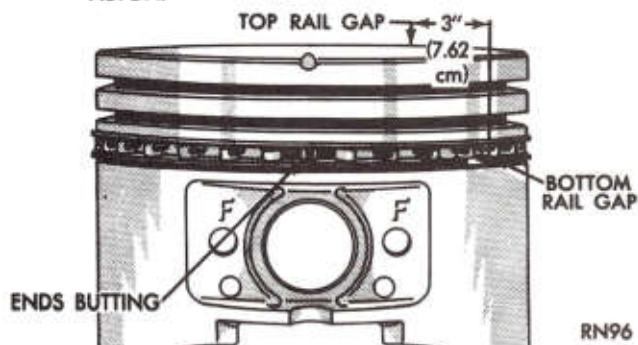


Fig. 44—Proper Oil Ring Installation

inch engines, and Tool C-3562 for 360 cubic inch engines or C-4184 for both engines. Be sure the identification mark (a drill point, stamped letter "O", oval depression or word top) on each compression ring is to the top of the piston when ring is installed.

CRANKSHAFT IDENTIFICATION

A crankshaft which has one or more connecting rod or main bearing journals undersize will be stamped with 1/4" letters on the milled flat on the number 8 crankshaft counterweight on 318 crankshafts and on the number 3 crankshaft counterweight of the 360 crankshafts (Fig. 45).

"RX" indicates all rod journals are .010 inch undersize; "MX" indicates all main journals are .010 inch undersize.

Undersize Journal	Identification Stamp
.001 inch (Rod)	R1-R2-R3 or R4
.010 inch (Rod)	RX
.001 inch (Main)	M1-M2-M3-M4 or M5
.010 inch (Main)	MX

Balance of V8 Engine Damper, Crankshaft and Torque Converter

360 cubic inch engines have external crankshaft balance. External balance is identified by the off-center weight cast in the vibration damper hub and the larger balance weights welded on the torque converter. Both of these items will be present on a crankshaft with external balance.

Therefore, when replacing the damper, crankshaft, or torque converter on any V8 engine it is important to use correct part numbers. In addition a damper or torque converter being replaced should look the same with respect to having or not having off-center weights.

When a crankshaft is replaced, all main and connecting rod bearings should be replaced with new bearings. Therefore, selective fittings of the bearings is not required when a crankshaft and bearings are replaced.

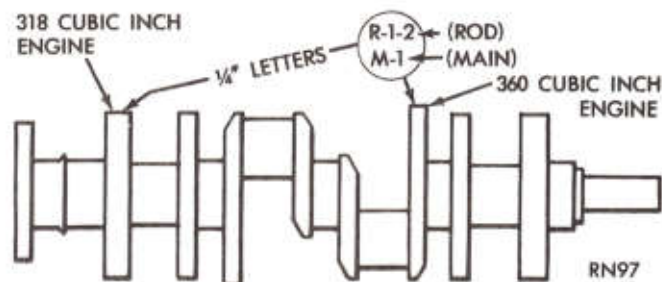


Fig. 45—Location of Crankshaft Identification on No. 8, Counterweight

CONNECTING RODS

Installation of Connecting Rod Bearings

Fit all rods on one bank until completed. Do not alternate from one bank to another, because when the rods are assembled to pistons correctly, they are not interchangeable from one bank to another.

The bearing caps are not interchangeable and should be marked at removal to insure correct assembly.

Each bearing cap has a small "V" groove across the parting face. When installing the lower bearing shell, make certain that the "V" groove in the shell is in line with the "V" groove in the cap. This provides lubrication of the cylinder wall in the opposite bank.

The bearing shells must be installed so that the tangs are in the machined grooves in the rods and caps.

Limits of taper or out-of-round on any crankshaft journals should be held to .001 inch (.025mm). Bearings are available in .001 (.025mm), .002 (.051mm), .003 (.076mm), .010 (.254mm) and .012 inch (.305mm) undersize. **Install the bearings in pairs. Do not use a new bearing half with an old bearing half. Do not file the rods or bearing caps.**

INSTALLING PISTON AND CONNECTING ROD ASSEMBLY

(1) Before installing pistons, and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 44).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, Tool C-385, over the piston and tighten with the special wrench (part of Tool C-385). **Be sure position of rings does not change during this operation.**

(4) Install connecting rod bolt protectors on rod bolts, the long protector should be installed on the numbered side of the connecting rod.

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

(6) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on crankshaft journal.

(7) The notch or groove on top of piston must be pointing toward front of engine and the larger chamber of the connecting rod bore must be installed toward crankshaft journal fillet.

(8) Install rod caps. Install nuts on cleaned and oiled rod bolts and tighten nuts to 45 ft. lb. (61 N·m).

CRANKSHAFT MAIN JOURNALS

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to .001 (.025mm) inch. Journal grinding should not exceed .012 (.305mm) inch under the standard journal diameter. Do NOT grind thrust faces of Number 3 main bearing. Do NOT nick crank pin or bearing fillets. After regrinding, remove rough edges from crankshaft oil holes and clean out all oil passages.

CAUTION: With the nodular cast iron crankshafts used in all 318 and 360 cubic inch engines it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

CRANKSHAFT MAIN BEARINGS

Bearing caps are not interchangeable and should be marked at removal to insure correct assembly. Upper and lower bearing halves are **NOT** interchangeable. Lower main bearing halves of 1, 2 and 4 are interchangeable. Upper main bearing halves of 1, 2 and 4 are interchangeable.

Upper and lower Number 3 bearing halves are flanged to carry the crankshaft thrust loads and are **NOT** interchangeable with any other bearing halves in the engine (Fig. 46). All bearing cap bolts removed during service procedures are to be cleaned and oiled before reinstallation. Bearing shells are available in standard and the following undersizes: .001 (.025mm), .002 (.051mm), .003 (.076mm), .010 (.254mm) and .012 inch (.305mm). Never install an undersize bearing that will reduce clearance below specifications.

Removal

(1) Remove oil pan and identify bearing caps before removal.

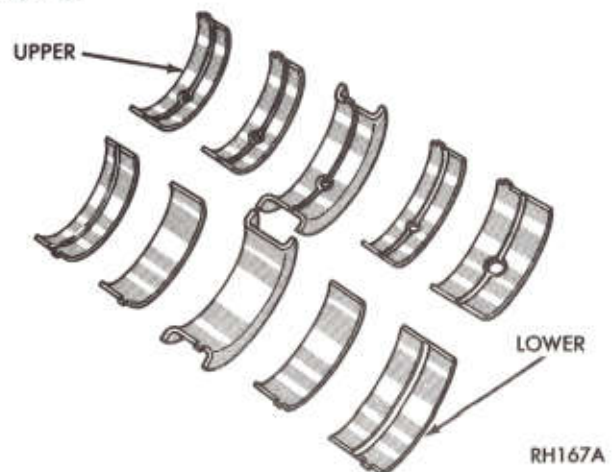


Fig. 46—Main Bearing Identification

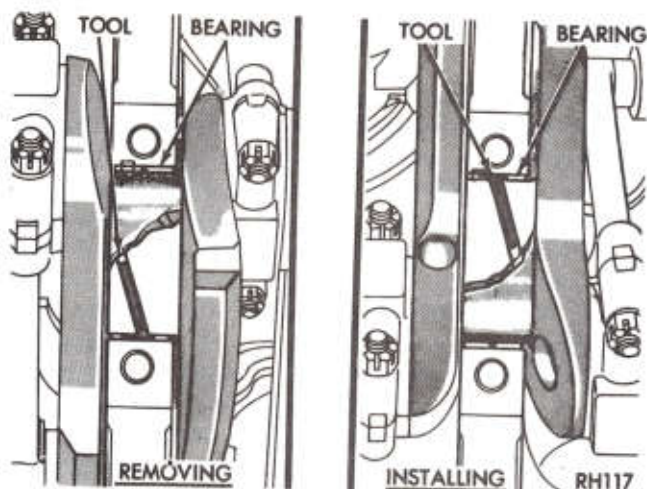


Fig. 47—Removing and Installing Upper Main Bearing with Tool C-3059

(2) Remove bearing caps one at a time. Remove upper half of bearing by inserting Tool C-3059 (Fig. 47) into the oil hole of crankshaft.

(3) Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

Installation

Only one main bearing should be selectively fitted while all other main bearing caps are properly tightened.

When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

(1) Start bearing in place, and insert Tool C-3059 into oil hole of crankshaft (Fig. 47).

(2) Slowly rotate crankshaft counter-clockwise sliding the bearing into position. Remove Tool C-3059.

REAR MAIN BEARING OIL SEALS

360 engine service seals are of split "Rubber Type" composition. The upper seal (half) can be installed without removing the crankshaft. The seal must be used as a complete upper and lower set.

318 engine service seal is a two piece, fitted, "Rope Type". The upper rope seal half can be installed with crankshaft removed or in vehicle with crankshaft installed. Lower rope seal half is required installation when upper seal is installed.

318 ENGINE SEAL SERVICE

Upper Rope Seal (In Vehicle—Crankshaft Installed)

(1) Remove defective upper seal and install new one using "Oil Seal Remover and Installer Tool KD-492" or equivalent (which includes complete instructions and is available from most auto supply stores).

(2) Carefully, trim the upper seal after installation to eliminate frayed ends.

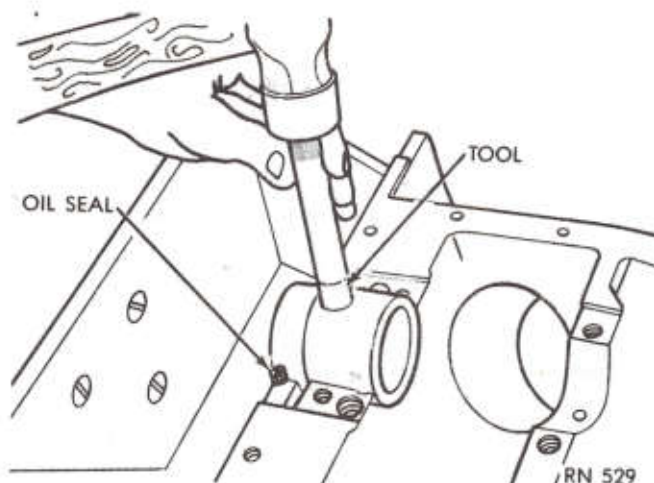


Fig. 48—Installing Upper (and Lower) Oil Seal with Tool C-3511

Upper Rope Seal (Crankshaft Removed)

(1) Install a new rear bearing oil seal in the cylinder block so that both ends protrude.

(2) Using Tool C-3511, tap seal down into position until tool is seated in bearing bore (Fig. 48).

(3) Hold tool in this position and cut off the portion of seal that extends below the block on both sides (Fig. 49).

Lower Rope Seal (Crankshaft Removed)

(1) Install a new seal in bearing cap so that both ends protrude.

(2) Using Tool C-3511, tap seal down into position until tool is seated in bearing bore.

(3) Hold tool in this position and cut off the portion of the seal that extends above the cap on both sides.

(4) Install cap seals into slots in bearing cap (Fig. 50). If this is not done, oil leakage will occur. Lightly oil seals with engine oil.

(5) Assemble bearing cap to cylinder block. Install

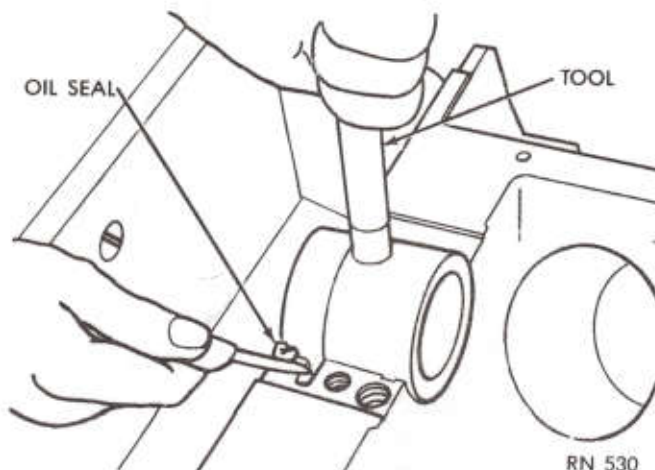


Fig. 49—Trimming Upper (or Lower) Oil Seal

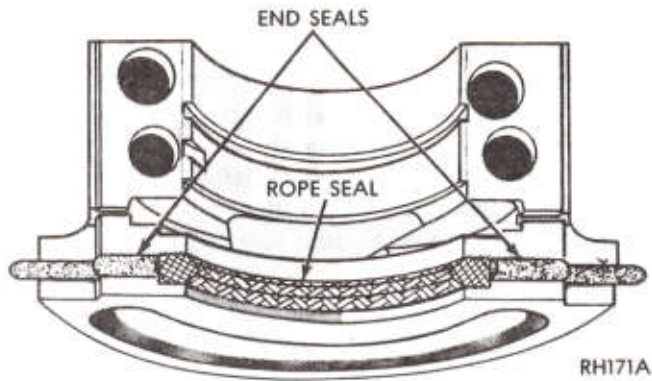


Fig. 50—Rear Main Bearing Cap (318 Engine)

cleaned and oiled cap bolts and torque to 85 ft. lbs. (115 N·m).

(6) Reinstall oil pump. Add sealer at bearing cap to block joint (Fig. 51). To provide oil pan end sealing. Install oil pan.

360 ENGINE SEAL SERVICE

Removing Seals

Rubber Type-Lower. Remove oil seal by pushing the end with a small screwdriver.

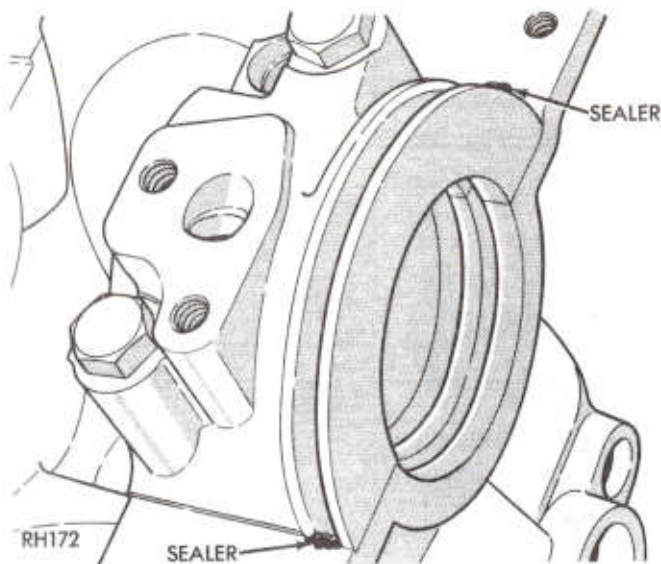


Fig. 51—Oil Pan End Seal at Rear Bearing

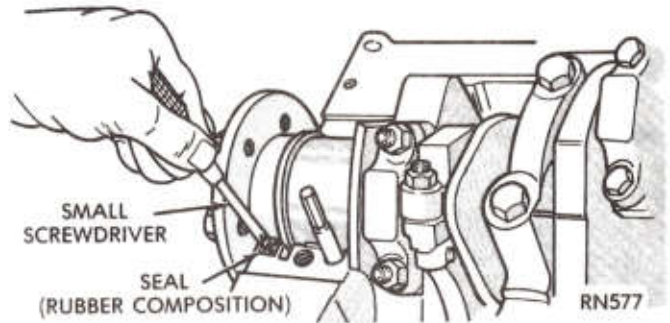


Fig. 52—Removing Composition (Rubber Type) Seal

Rubber-Type-Upper. Remove upper seal by pressing with a small screwdriver on the end of the seal being careful not to damage the crankshaft (Fig. 52).

Installing Seals

CAUTION: Always wipe crankshaft surface clean, then oil lightly before installing a new seal.

- (1) Lightly oil lips of crankshaft seals.
- (2) Rotate half seal into cylinder block with paint stripe toward rear. Be careful not to shave or cut outer surface of seal.
- (3) Place the other half seal in bearing cap with paint stripe toward rear.
- (4) Apply RTV sealer adjacent to rubber seal (Fig. 53). Assemble bearing cap to block immediately after applying sealer. Install cleaned and oiled bolts. Torque to 85 ft. lbs. (115 N·m).

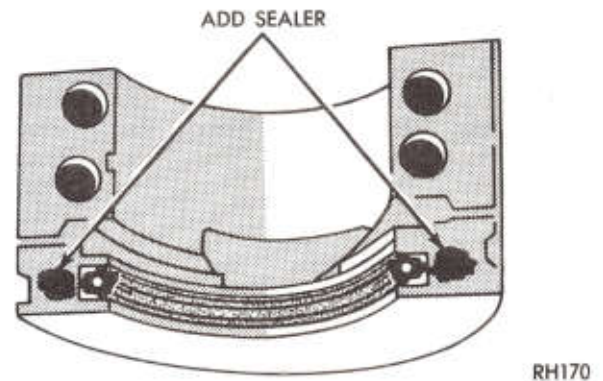


Fig. 53—Rear Main Bearing Cap (360 Engine)

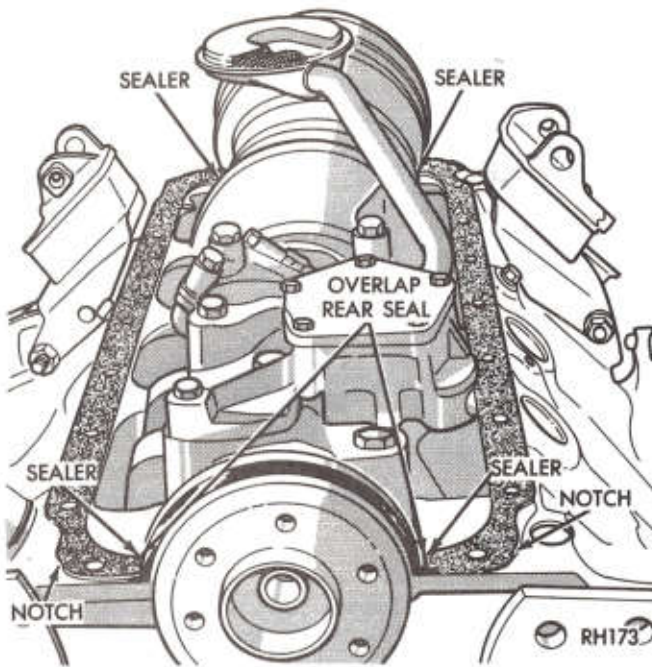


Fig. 55—Oil Pan Gaskets and Rear Seal Installation

Disassembly

(1) To remove the relief valve, proceed as follows:

(a) Remove cotter pin, drill a 1/8 (3.175mm) inch hole into the relief valve retainer cap and insert a self-threading sheet metal screw into cap.

(b) Clamp screw into a vise and while supporting oil pump, remove cap by tapping pump body using a soft hammer. Discard retainer cap and remove spring and relief valve (Fig. 56).

(2) Remove oil pump cover bolts and lockwashers, and lift off cover.

(3) Discard oil seal ring. Replace with new seal ring. **New pumps may not have seal ring.**

(4) Remove pump rotor and shaft, and lift out outer rotor.

(5) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 57).

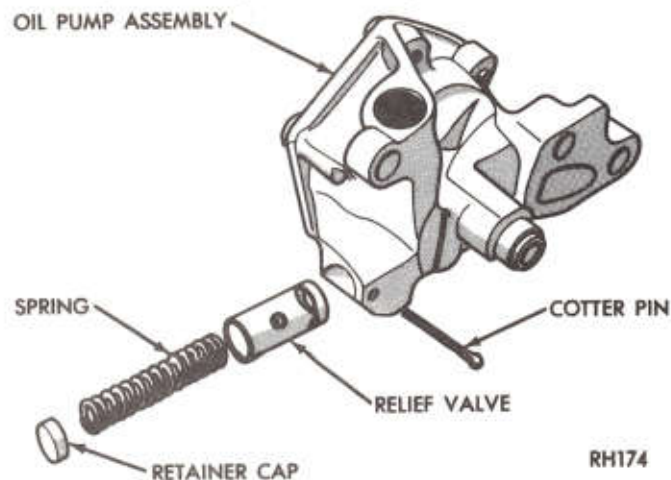


Fig. 56—Oil Pressure Relief Valve, Disassembled

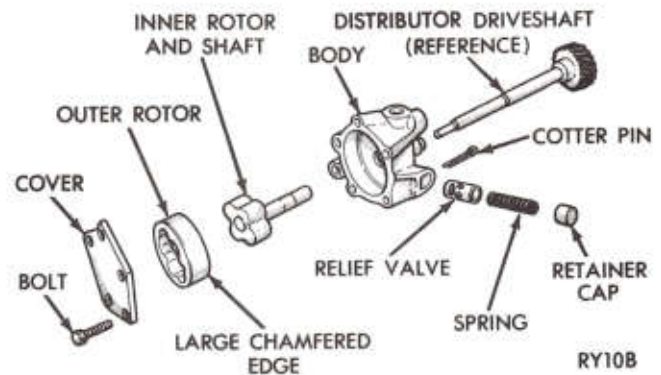


Fig. 57—Oil Pump, Disassembled View

Inspection and Repair

(1) Clean all parts thoroughly. Mating surface of the oil pump cover should be smooth. Replace pump assembly if cover is scratched or grooved.

(2) Lay a straight edge across the pump cover surface (Fig. 58). If a .0015 inch (.038mm) feeler gauge can be inserted between cover and straight edge, pump assembly should be replaced.

(3) Measure thickness and diameter of **outer rotor**. If outer rotor thickness measures .825 inch (20.9mm) or less, (Fig. 59), or if the diameter is 2.469 inches (62.7mm) or less, replace outer rotor.

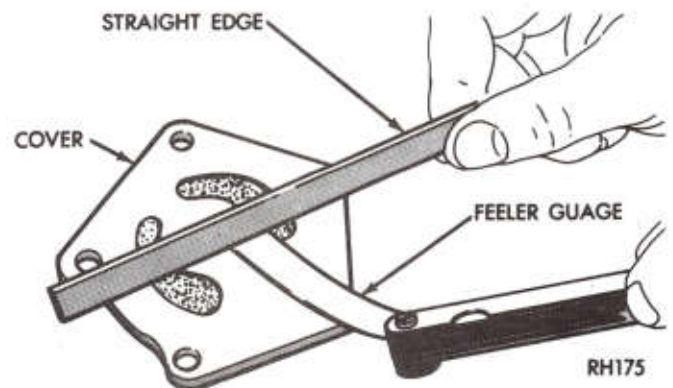


Fig. 58—Checking Oil Pump Cover Flatness

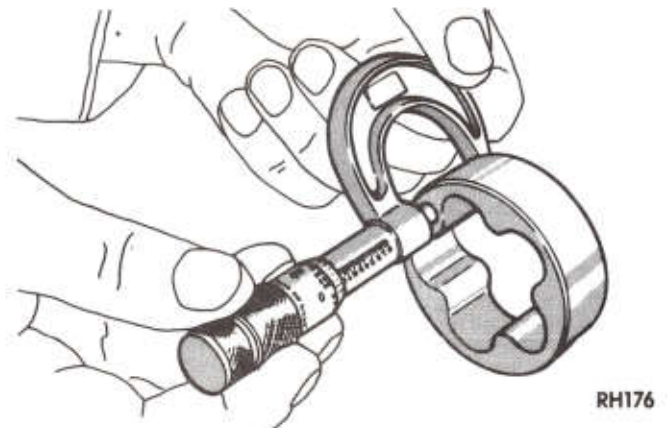
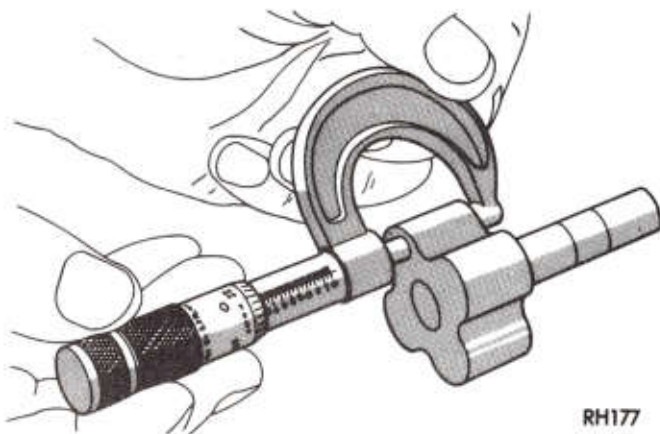


Fig. 59—Measuring Outer Rotor Thickness



RH177

Fig. 60—Measuring Inner Rotor Thickness

(4) If inner rotor measures .825 inch (20.9mm) or less, replace inner rotor and shaft assembly (Fig. 60).

(5) Slide outer rotor into pump body, press to one side with fingers and measure clearance between rotor and pump body (Fig. 61). If measurement is .014 inch (.356mm) or more, replace oil pump assembly.

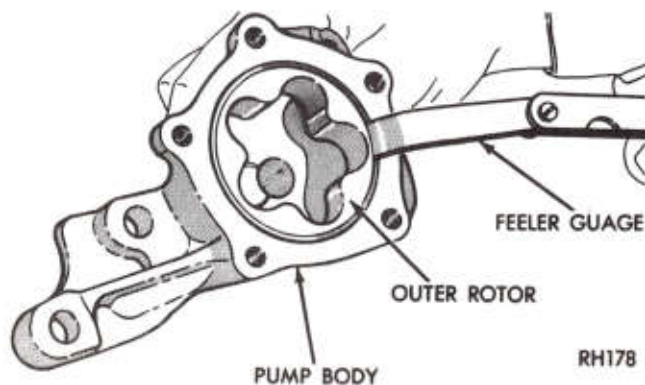
(6) Install inner rotor and shaft into pump body. If clearance between inner and outer rotors (Fig. 62) is .008 inch (.203mm) or more, replace shaft and both rotors.

(7) Place a straight edge across the face of the pump, between bolt holes. If a feeler gauge of .004 inch (.102mm) or more can be inserted between rotors and the straight edge, replace pump assembly (Fig. 63).

(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

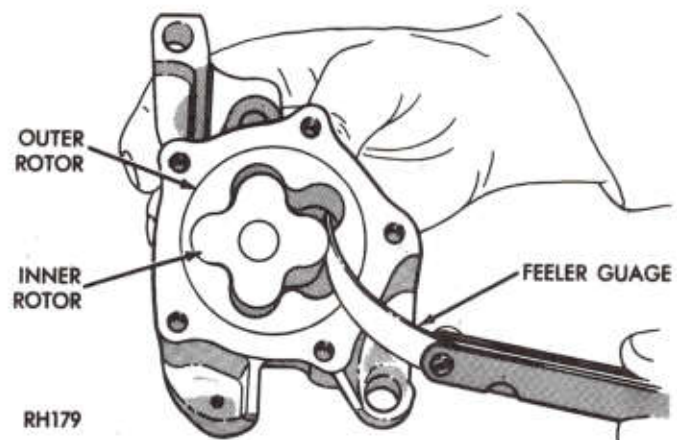
(9) The relief valve spring has a free length of approximately 1.95 inch (49mm) and should test between 19.5 and 20.5 pounds when compressed to 1-11/32 inch (34mm). Replace spring that fails to meet specifications. (Fig. 64).

(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.



RH178

Fig. 61—Measuring Outer Rotor Clearance in Housing



RH179

Fig. 62—Measuring Clearance Between Rotors

OIL LINE PLUG

The oil line plug is located in the vertical passage in the block between the Oil-To-Filter and Oil-From-Filter passages. (Fig. 54). Misinstallation or absence could cause erratic, low or no oil pressure.

Inspection

(1) Remove oil pressure sending unit from back of block.

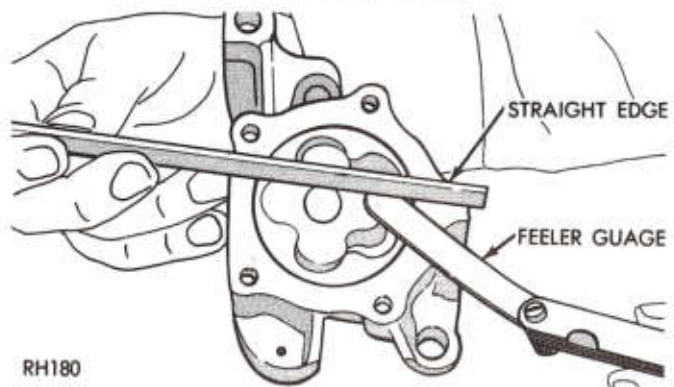
(2) Insert a 1/8" finish (3.175mm) wire or equivalent into passage.

(3) Plug should be 7-1/2 to 7-11/16 inches (190 to 195.2mm) from machined surface of block. (See Fig. 54), and 2-1/8 to 2-5/16 inches (54.0 to 57.7mm) from bottom of the block.

(4) If plug is too high, use a suitable flat dowel drift to position properly.

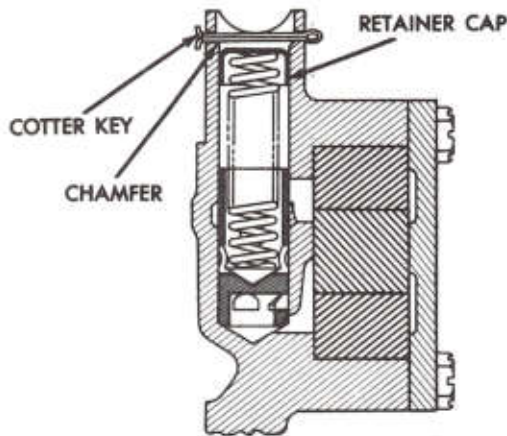
(5) If plug is off position. Remove oil pan and No. 5 main bearing cap. Use suitable flat dowel to remove plug.

(6) Upon reinstallation, use stud n' bearing mount adhesive P/N 4057987 (package 4318032) on outside diameter of plug to insure retention of position. Assemble engine and check oil pressure.



RH180

Fig. 63—Measuring Clearance Over Rotors

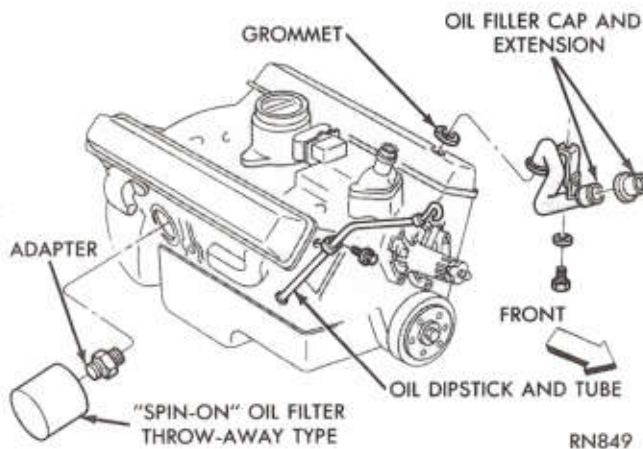


RN98

Fig. 64—Proper Installation of Retainer Cap

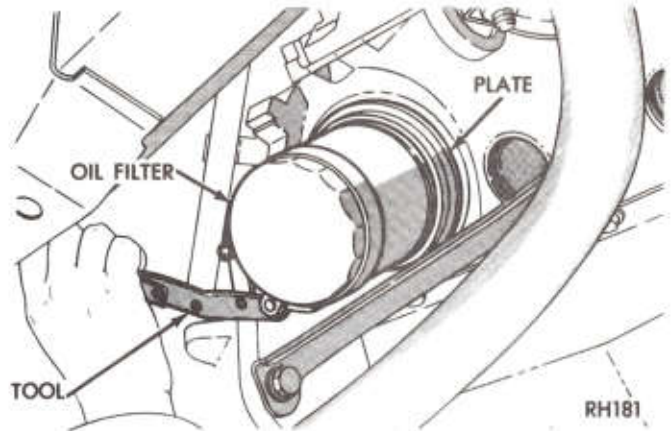
Oil Pump Assembly and Installation

- (1) Assemble pump, using new parts as required.
- (2) Install new oil seal rings between cover and pump body. Tighten cover bolts to 95 in. lb. (11 N·m).



RN849

Fig. 65—Oil Filter, Dipstick, and Oil Filler Locations



RH181

Fig. 66—Removing Oil Filter with Tool C-4065

(3) Prime oil pump before installation by filling rotor cavity with engine oil.

(4) Install oil pump. During installation slowly rotate pump body to ensure driveshaft-to-pump rotor shaft engagement and that pump is fully seated before installing fasteners. Tighten attaching bolts to 30 ft. lbs. (41 N·m).

OIL FILTER

The oil filter should be replaced to coincide with every second oil change.

(1) Using Tool C-4065, unscrew filter from base and discard (Figs. 65 and 66).

(2) Wipe base clean, then inspect gasket contact surface.

(3) Lubricate gasket of new filter with clean engine oil.

(4) Install and tighten filter to 15 foot pounds torque, or 3/4 to 1 turns after gasket contacts base. Use filter wrench, if necessary.

(5) Start engine and check for leaks.

8-CYLINDER ENGINES 318 & 360 CUBIC INCH

ENGINE	318	360
Type	90° V	90° V
Number of Cylinders	8	8
Bore	3.91"	4.000"
Stroke	3.31"	3.58"
Piston Displacement	318 cu. in.	360 cu. in.
Compression ratio	9.0 to 1	8.5 to 1
Minimum Compression Pressure, see "Engine Performance" in General Information	100 psi	100 psi
Maximum Variation between Cylinders (any one engine)	25%	25%
Firing Order	1-8-4-3-6-5-7-2	1-8-4-3-6-5-7-2
Basic Timing	Refer to Emission Control Information Label on Vehicle	
CYLINDER NUMBERING (front to rear)		
Left Bank	1-3-5-7	1-3-5-7
Right Bank	2-4-6-8	2-4-6-8
CYLINDER BLOCK		
Cylinder Bore (standard)	3.910"—3.912"	4.000"—4.002"

8-CYLINDER ENGINES

ENGINE - COMPONENTS	318	360
Cylinder Bore Out-of-Round (Maximum allowable before reconditioning)	.005"	.005"
Cylinder Bore Taper (Maximum allowable before reconditioning)	.010"	.010"
Reconditioning Working Limits (for taper and out-of-round)	.001"	.001"
Maximum Allowable Oversize (cylinder bores)	.040"	.040"
Tappet Bore Diameter	.9051"—.9059"	.9051"—.9059"
Distributor Lower Drive Shaft Bushing (press fit in block)	.0005"—.014"	.0005"—.014"
Shaft to Bushing Clearance	.0007"—.0027"	.0007"—.0027"
PISTONS		
Type Material	Alloy Tin Coated	Alloy Tin Coated
Land Clearance (Diametrical)	.019"—.024"	.020"—.026"
Clearance at Top of Skirt	.0005"—.0015"	.0005"—.0015"
Weight (std. through .040" oversize)	595 gms.	584 gms.
Piston Length (overall)	3.47"	3.19"
Ring Groove Depth		
No. 1	.205"	.210"
No. 2	.205"	.210"
No. 3	.194"	.199"
Pistons for Service	Std. and .020" Oversize	Std. and .020" Oversize
PISTON PINS		
Type	Press Fit in Rods	Press Fit in Rod
Diameter	.9841"—.9843"	.9841"—.9843"
Length	2.990"—.3020"	2.990"—.3020"
Clearance in Piston (Light Thumb Push @ 70°F.)	.0000"—.0005"	.00025"—.00075"
End Play	None	None
Clearance in Rod	.0007"—.0014" (Interference)	.0007"—.0014" (Interference)
Pins for Service	Standard, .003" and .008" oversize	Standard, .003" and .008" oversize
PISTON RINGS		
Number of Rings per Piston	3	3
Compression	2	2
Oil	1	1
Oil Ring Type	3-piece steel rail chrome-face	3-piece steel rail chrome-face
Ring Width		
Compression	.0770"—.0780"	.0770"—.0780"
Oil—Steel rails	.0252" Max	.0252" Max
Ring Gap		
Compression	.010"—.020"	.010"—.020"
Oil—Steel rails	.015"—.055"	.015"—.055"
Ring Side Clearance		
Compression	.0015"—.0030"	.0015"—.0030"
Oil—Steel rails	.0002"—.005"	.0002"—.005"
Service Rings		
Ring Gap		
Compression	.010"—.020"	.010"—.020"
Oil (Steel rails)	.010"—.062"	.015"—.062"
Ring Side Clearance		
Compression	.0015"—.004"	.0015"—.004"
Oil (Steel rails)	.0002"—.005"	.0002"—.005"
CONNECTING RODS		
Length (Center to Center)	6.121"	6.121"
Weight (less bearing shells)	726 Grams	758 gms.
Side Clearance (two rods)	.006"—.014"	.006"—.014"
Piston Pin Bore Diameter	.9829"—.9834"	.9829"—.9834"

8-CYLINDER ENGINES

ENGINE - COMPONENTS	318	360
CONNECTING ROD BEARINGS		
Type	Tin-Aluminum	Tri-Metal
Diameter and Width	2.126"x.842"	2.126"x.842"
Clearance Desired	.0005"—.0022"	.0005"—.0022"
Maximum Allowable	.0022"	.0025"
Bearings for Service	Std., .001", .002", .010", .012"	Std., .001", .002", .010", .012"
CRANKSHAFT		
Type	Fully Counter-Balanced	Fully Externally-Balanced
Bearings	Steel Backed Babbitt #3 Thrust Aluminum	Steel Backed Lead-Aluminum #5 Babbitt
Thrust Taken By	No. 3 Main Bearing	No. 3 Main Bearing
End Play	.002"—.007"	.002"—.009"
Maximum Allowable	.010"	.010"
Diametral Clearance Desired #1	.0005"—.0015"	.0005"—.0015"
Maximum Diametral Clearance Allowed #1	.0015"	.0015"
Diametral Clearance Desired #2, 3, 4 and 5	.0005"—.0020"	.0005"—.0020"
Diametral Clearance Allowed #2, 3, 4 and 5	.0025"	.0025"
Finish at Rear Oil Seal Surface	Diagonal Knurling	Diagonal Knurling
MAIN BEARING JOURNALS		
Diameter	2.4995"—2.5005"	2.8095"—2.8105"
Maximum Allowable Out-of-Round and/or Taper	.001"	.001"
Bearings for Service Available in Standard and the following undersizes	.001", .002", .003", .010", .012"	.001", .002", .003", .010", .012"
CONNECTING ROD JOURNALS		
Diameter	2.124"—2.125"	2.124"—2.125"
Maximum Allowable Out-of-Round and/or Taper	.001"	.001"
CAMSHAFT		
Drive	Chain	Chain
Bearings	Steel Backed Babbitt	Steel Backed Babbitt
Number	5	5
Diametral Clearance	.001"—.003"	.001"—.003"
Maximum Allowable Before Reconditioning	.005"	.005"
Thrust Taken By	Thrust Plate	Thrust Plate
End Play	.002"—.010"	.002"—.010"
Maximum Allowable	.010"	.010"
CAMSHAFT JOURNALS		
Diameter		
No. 1	1.998"—1.999"	1.998"—1.999"
No. 2	1.982"—1.983"	1.982"—1.983"
No. 3	1.967"—1.968"	1.967"—1.968"
No. 4	1.951"—1.952"	1.951"—1.952"
No. 5	1.5605"—1.5615"	1.5605"—1.5615"
CAMSHAFT BEARINGS		
Diameter		
No. 1	2.000"—2.001"	2.000"—2.001"
No. 2	1.984"—1.985"	1.984"—1.985"
No. 3	1.969"—1.970"	1.969"—1.970"
No. 4	1.953"—1.954"	1.953"—1.954"
No. 5	1.5625"—1.5635"	1.5625"—1.5635"
VALVE TIMING		
Intake Opens (BTC)	10°	18°
Intake Closes (ABC)	50°	54°
Exhaust Opens (BBC)	52°	57°
Exhaust Closes (ATC)	16°	15°
Valve Overlap	26°	33°
Intake Valve Duration	240°	252°
Exhaust Valve Duration	248°	252°

8-CYLINDER ENGINES

ENGINE - COMPONENTS	318	360
TIMING CHAIN		
Number of Links	68	68
Pitch	.375"	.375"
Width	.625"	.625"
TAPPETS		
Type	Hydraulic	
Body Diameter	.9035"—.9040"	
Clearance in Block	.0011"—.0024"	
Service Tappets Available	Std., .001", .008", .030"	
Dry Lash	.060"—.210"	
Push Rod Length	6.794"-6.814"	7.505"—7.525"
CYLINDER HEAD		
Valve Seat Run-Out (Maximum)	.003"	
Intake Valve Seat Angle	45°—45-1/2°	
Seat Width (finish)	.065"—.085"	
Exhaust Valve Seat Angle	45°—45-1/2°	
Seat Width (finish)	.080"—.100"	
Cylinder Head Gasket (Thickness compressed)	.033"	
VALVE GUIDES		
Type	Cast in Head	
Guide Bore Diameter	.374"—.375" (Std.)	
VALVES—(INTAKE)		
Head Diameter	1.780"	1.88"
Length (overall)	4.962"—4.987"	4.969"—4.994"
Stem Diameter (Standard)	.372"—.373"	
Stem to Guide Clearance	.001"—.003"	
Maximum Allowable (by rocking method)	.017"	
Face Angle	44-1/2°—45°	
Valves for Service (oversize stem diam.)	Std., .005", .015", .030"	
Lift (Zero Lash)	.373"	.410"
VALVES—(EXHAUST)		
Head Diameter	1.517"	1.617"
Length (overall)—Without Rotators	4.969"—5.005"	4.975"—4.990"
—With Rotators	4.977"—5.012"	4.978"—5.012"
Stem Diameter (Standard)	.371"—.372"	
Stem to Guide Clearance	.002"—.004"	
Maximum Allowable (by rocking method)	.017"	
Face Angle	44-1/2°—45°	
Valves for Service (oversize stem diam.)	Std., .005", .015", .030"	
Lift (Zero Lash)	.400"	.410"

ENGINE VALVE SPRINGS	318 & 360	318	360
LOCATION/IDENTIFICATION	Intake	Exhaust With Rotator	Exhaust With Rotator
Number	8	8	8
Color	Blue	White	Yellow
Free Length (Approx.)	2.00"	1.81"	1.81"
Wire Diameter	.192"	.185"	.192"
Number of coils	6.4	5.8	5.6
Load when compressed to (valve closed)	78-88 lbs. @ 1-11/16"	80-90 lbs. @ 1-31/64"	80-90 lbs. @ 1-31/64"
Load when compressed to (valve open)	170-184 lbs. @ 1-5/16"	180-194 lbs. @ 1-1/16"	183-199 lbs. @ 1-1/16"
Maximum allowable out of plumb	1/16"	1/16"	1/16"
Valve spring installed height (spring seat to retainer)	1-5/8"— 1-1/16"	1-29/64"— 1-33/64"	1-29/64"— 1-33/64"
Use 1/16" spacer to reduce spacing height when over specifications			

ENGINE LUBRICATION

	"318"	"360"
Pump Type	Rotary	Rotary
Capacity (qts.) U.S.	Full Pressure	Full Pressure
Pump Drive	4**	4**
***Minimum Pump Pressure @ Idle	Camshaft	Camshaft
***Operating Pressure at 3000 rpm (Engine)	6 psi	6 psi
Pressure Drop Resulting from Clogged Filter	30—80 psi	30—80 psi
Oil Filter Type	7—9 psi	7—9 psi
	Full Flow	Full Flow

**When Filter Element is Replaced, add 1 U.S. quart.

***Engine Fully Warmed, CAUTION; If pressure is "0" at curb idle, DO NOT RUN engine at 3000 rpm.

OIL PUMP—INSPECTION LIMITS FOR REPLACEMENT**ENGINE OIL PUMP****318****360**

Oil Pump Cover Out of Flat	.0015 inch or more	.0015 inch or more
Outer Rotor Thickness	.825 inch or less	.825 inch or less
Outer Rotor Diameter	2.469 inch or less	2.469 inch or less
Inner Rotor Thickness	.825 inch or less	.825 inch or less
Clearance Over Rotors—Outer	.004 inch or more	.004 inch or more
Inner	.004 inch or more	.004 inch or more
Outer Rotor Clearance	.014 inch or more	.014 inch or more
Tip Clearance Between Rotors	.008 inch or more	.008 inch or more

OVERSIZE AND UNDERSIZE ENGINE COMPONENT MARKINGS

Displacement	Condition	Identification	Location of Identification
318 Cu. In. 360 Cu. In.	.001" U/S Crankshaft	R or M M-2-3 etc. (indicating No. 2 & 3 main bearing journal) and/or R-1-4 etc. (Indicating No. 1 & 4 connecting rod journal)	Milled flat on number eight crankshaft counterweight on 318 cranks. On 360 cranks it is on the number three counterweight.
	.010" U/S Crankshaft	RX or MX MX (Indicates .010" U/S all main journals) and/or RX (Indicating .010" U/S all rod journals)	Milled flat on number eight crankshaft counterweight on 318 cranks. On 360 cranks it is on the number three counterweight.
	.020" O/S Cylinder Bores	A	Following engine serial number
	.008" O/S Tappets	◆	3/8" diamond-shaped stamp Top pad—Front of engine and flat ground on outside surface of each O/S tappet bore.
	.005" O/S Valve Stems	X	Milled pad adjacent to two 3/8" tapped holes on each end of cylinder head.

318 AND 360 CUBIC INCH ENGINE

	Thread Size	*Torque Foot-Pounds	*Newton Meters
Alternating Adjusting Strap Bolt	5/16"—18	200 in.-lbs.	(23)
Alternator Adjusting Strap Mounting Bolt	3/8"—16	30	(41)
Alternator Bracket Bolt	3/8"—16	30	(41)
Alternator Mounting Pivot Nut	3/8"—16	30	(41)
Camshaft Sprocket Lockbolt	7/16"—14	50	(68)
Camshaft Thrust Plate	5/16"—18	210 in.-lbs.	(24)
Chain Case Cover Bolt	3/8"—16	35	(47)
Clutch Housing Bolt	3/8"—16	30	(41)
	7/16"—14	50	(68)
Connecting Rod Nut	3/8"—24	45	(61)
Crankshaft Bolt (Vibration Damper)	3/4"—16	100	(136)
Cylinder Head Bolt - 318	1/2"—13	105	(143)
Cylinder Head Bolt - 360	1/2"—13	105	(143)
Cylinder Head Cover	1/4"—20	80 in.-lbs.	(9)
Distributor Clamp Bolt	5/16"—18	200 in.-lbs.	(23)
Engine Front Mount Insulator to Frame Nut		75	(102)
Engine Front Mount Insulator to Engine Nut		65	(88)
Engine Rear Mount Insulator to Crossmember Nut		50	(68)
Engine Rear Mount Insulator to Extension		50	(68)
Engine Rear Mount Crossmember to Frame Nut		75	(102)
Exhaust Manifold Screw	5/16"—18	20	(27)
Nut	5/16"—24	15	(20)
Exhaust Pipe Flange Nut	7/16"—14	24	(33)
Fan Blade Attaching Bolts	5/16"—18	200 in.-lbs.	(23)
Flex Plate to Converter	5/16"—24	270 in.-lbs.	(31)
Flex Plate to Crankshaft	7/16"—20	55	(75)
Flywheel to Crankshaft	7/16"—20	55	(75)
Fuel Pump Attaching Bolt	3/8"—16	30	(41)
Intake Manifold Bolt	3/8"—16	45	(61)
Main Bearing Cap Bolt	1/2"—13	85	(115)
Oil Pan Drain Plug	1/2"—20	20	(27)
Oil Pan Screw	5/16"—18	200 in.-lbs.	(23)
Oil Pump Cover Bolt	1/4"—20	95 in.-lbs.	(11)
Oil Pump Attaching Bolt	3/8"—16	30	(41)
Oil Filter Attaching Stud	3/4"—16	50	(68)
Oil Pressure Gauge Sending Unit	1/8" NPTF	60 in.-lbs.	(7)
Rocker Shaft Bracket Bolt (Also see text)	5/16"—18	200 in.-lbs.	(23)
Spark Plug	14mm	30	(41)
Starter Mounting Bolt	7/16"—14	50	(68)
Temperature Gauge Sending Unit	1/8" NPTF	60 in.-lbs.	(7)
Vibration Damper Screw to Crankshaft	3/4"—16	100	(136)
Water Pump to Housing Bolt	3/8"—16	30	(41)
A/C Compressor Bracket to Water Pump Bolt	3/8"—16	30	(41)
A/C Compressor to Bracket Nut	7/16"—14	50	(68)
A/C Compressor Support Bolts	3/8"—16	30	(41)

*All Critical Fasteners should be clean and lightly oiled.

EXHAUST SYSTEM AND INTAKE MANIFOLD

CONTENTS

	Page		Page
CARBURETOR AIR HEATER	8	GENERAL INFORMATION	1
CATALYTIC CONVERTER	1	INTAKE MANIFOLD	
EXHAUST DIAGNOSIS	8	V-SIX CYLINDER ENGINE	9
EXHAUST GAS RECIRCULATION (EGR)	1	INTAKE MANIFOLD	
EXHAUST MANIFOLD		V-EIGHT CYLINDER ENGINES	11
V-EIGHT CYLINDER ENGINES	12	MANIFOLD HEAT CONTROL VALVE	12
EXHAUST MANIFOLD		SERVICE PROCEDURES	8
V-SIX CYLINDER ENGINE	10	TIGHTENING REFERENCE	13
EXHAUST PIPES,			
MUFFLERS AND TAILPIPES	8		

GENERAL INFORMATION

All systems use stainless steel components.

All engines have a thermostatic or vacuum controlled heat valve in the exhaust manifold for faster warmup and improved driveability after cold start. All engine exhaust manifolds are equipped with ball flange outlets to assure a tight seal and strain free connections in alignment of the exhaust system and have the correct clearance from nearby parts.

Catalytic Converter

A catalyst is a material whose presence alters the rate of a chemical reaction, enabling a reaction to occur at a lower temperature than would otherwise be possible. Use of a device in an exhaust system which contains a catalyst represents one potential method of burning exhaust gases into harmless materials. This device is normally called a catalytic converter or simply "Catalyst".

Chrysler Catalytic Converter looks very much like a small muffler. The exhaust pipe from the exhaust manifold to the catalytic converter is of stainless steel. The catalytic converter is also stainless steel. Heat shields are needed to protect the vehicle from high temperatures developed in the vicinity of the converter, which is mounted under the floor pan in the front seats area (Figs. 1 thru 6).

Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shields on vehicles so equipped. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectional fumes.

The combustion reaction facilitated by the catalyst releases additional heat in the exhaust system, causing temperature increases in the area of the reactor under severe operating conditions. Such conditions can exist when the engine misfires or otherwise does

not operate at peak efficiency. **Do not** remove spark plug wires from plugs or by any other means short out cylinders if exhaust system is equipped with catalytic converter.

The use of the catalysts also involves some non-automotive problems. Unleaded gasoline must be used to avoid poisoning the catalyst core. The catalytic converter has an access fitting and plug located on the lower front end of some catalytic converter equipped vehicles. Some models will have a lower converter shield.

Do not use fuel system cleaning agents added to the fuel tank or added to the carburetor for induction into the engine of vehicles equipped with catalyst emission control systems. These materials may be detrimental to the catalytic converter.

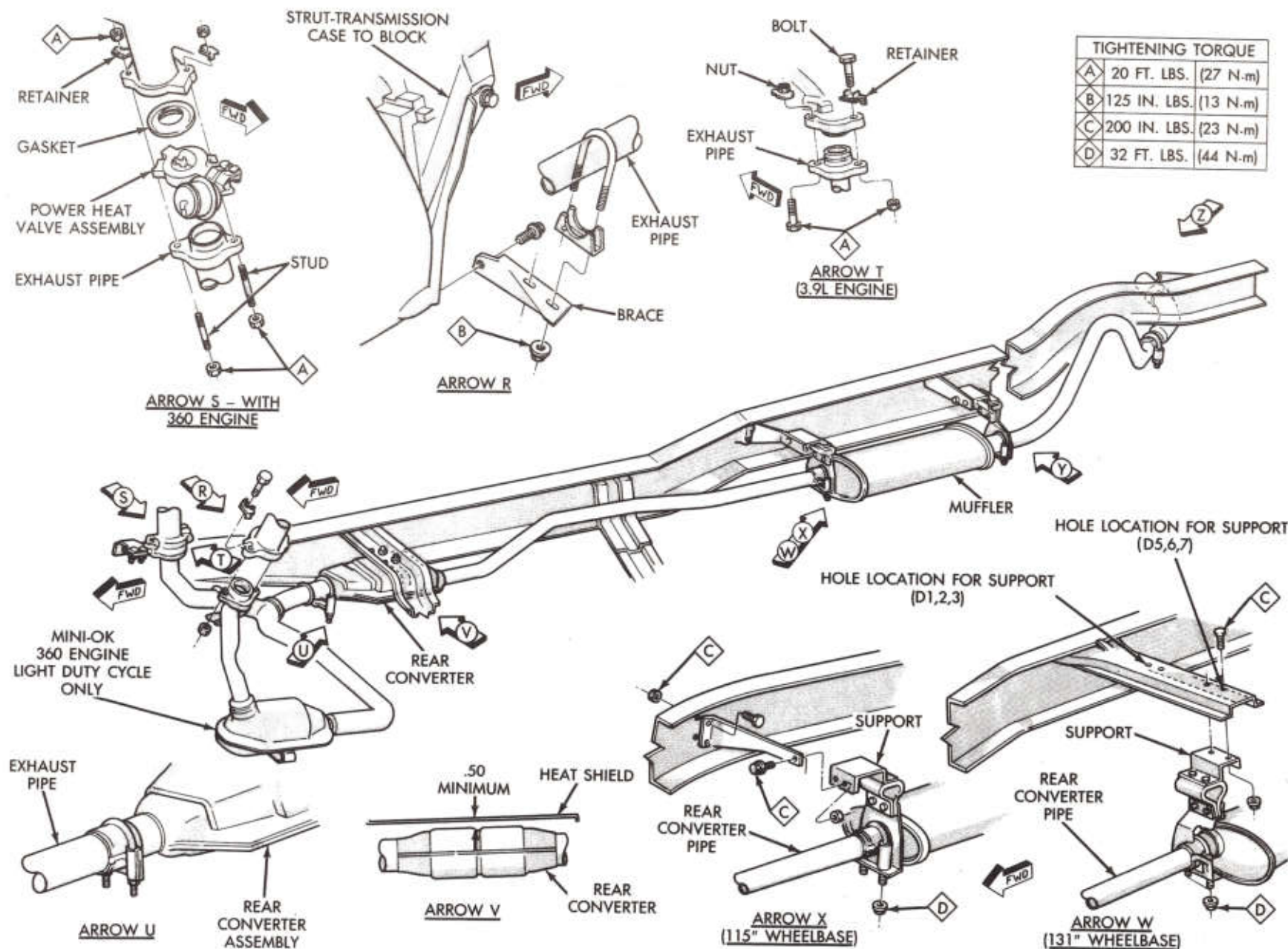
When replacement is required on any component of the exhaust system, it is most important that original equipment parts (or their equivalent) be used to assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

EXHAUST GAS RECIRCULATION (EGR)

Refer to Section 25 of this manual for complete description, diagnosis and service procedures on the exhaust gas recirculation system and components.

MANIFOLD HEAT CONTROL VALVE

A manifold heat control valve is located in the right side exhaust manifold on all engines. The thermostatic or vacuum controlled valve directs heated exhaust gases to the heat chamber in the intake manifold beneath the carburetor to help vaporize the fuel



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Fig. 1—Single Exhaust System, Light Duty, Except Sport Utility. For Views in Direction of Arrows See (Fig. 2)

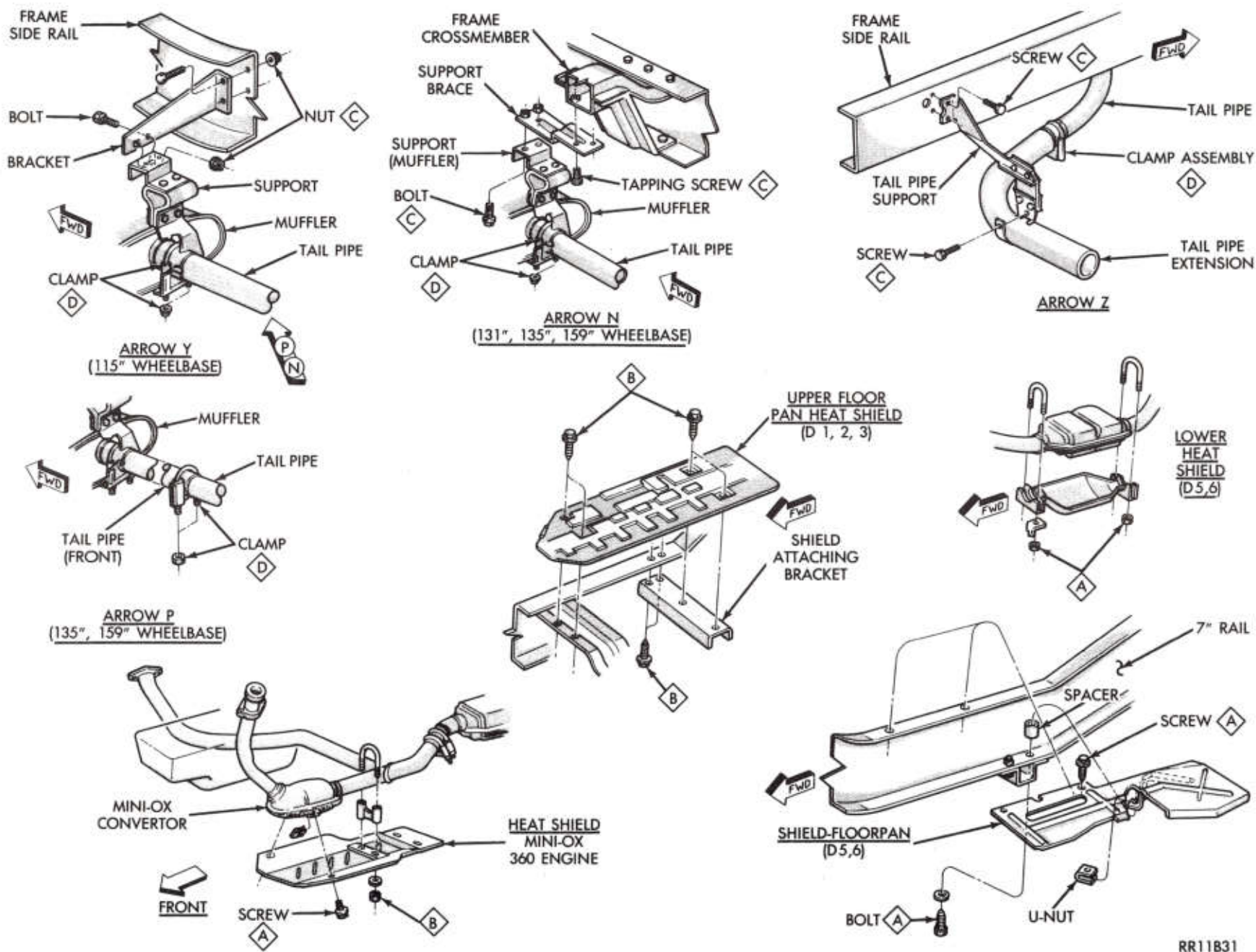


Fig. 2—System Detail for Figure 1

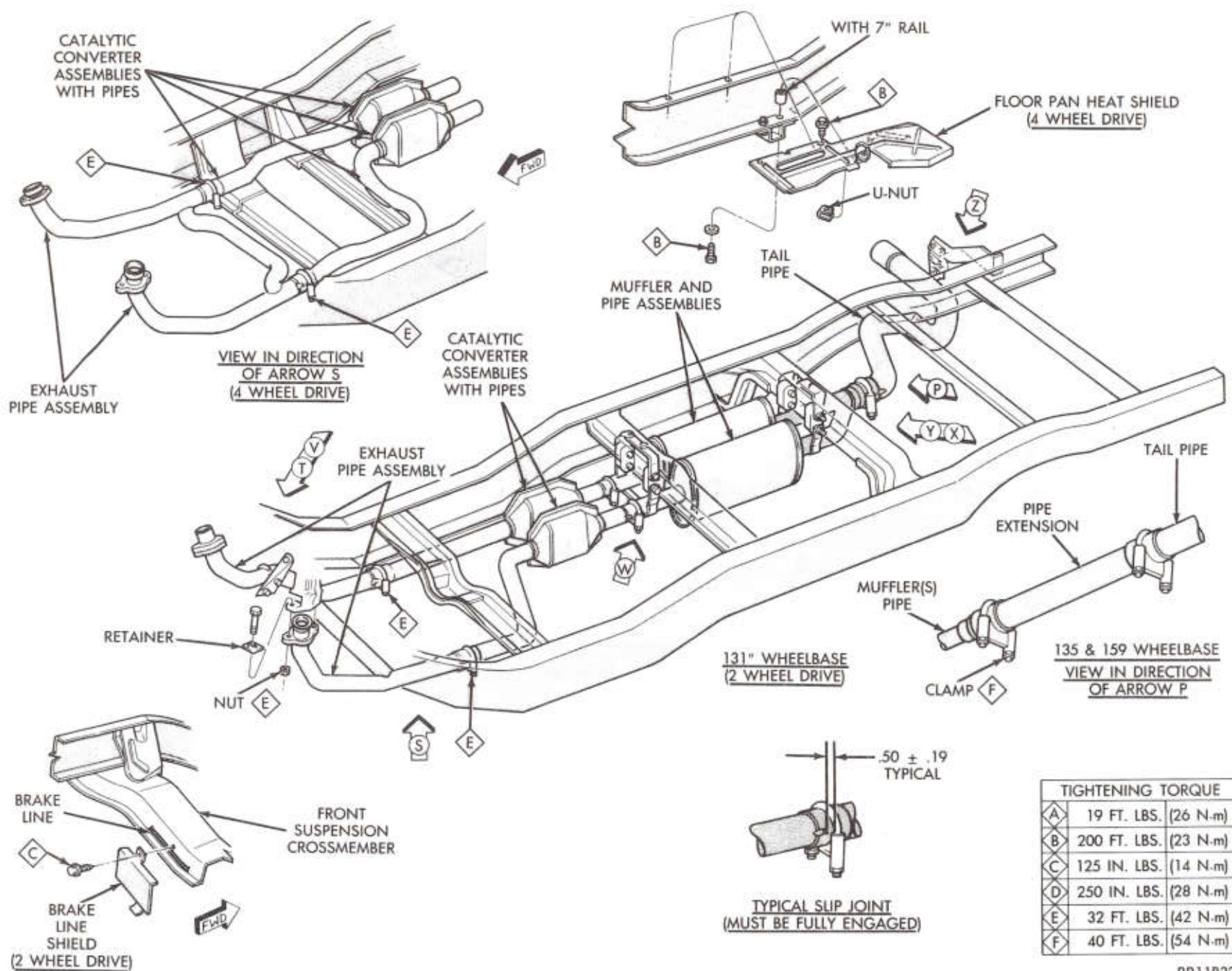
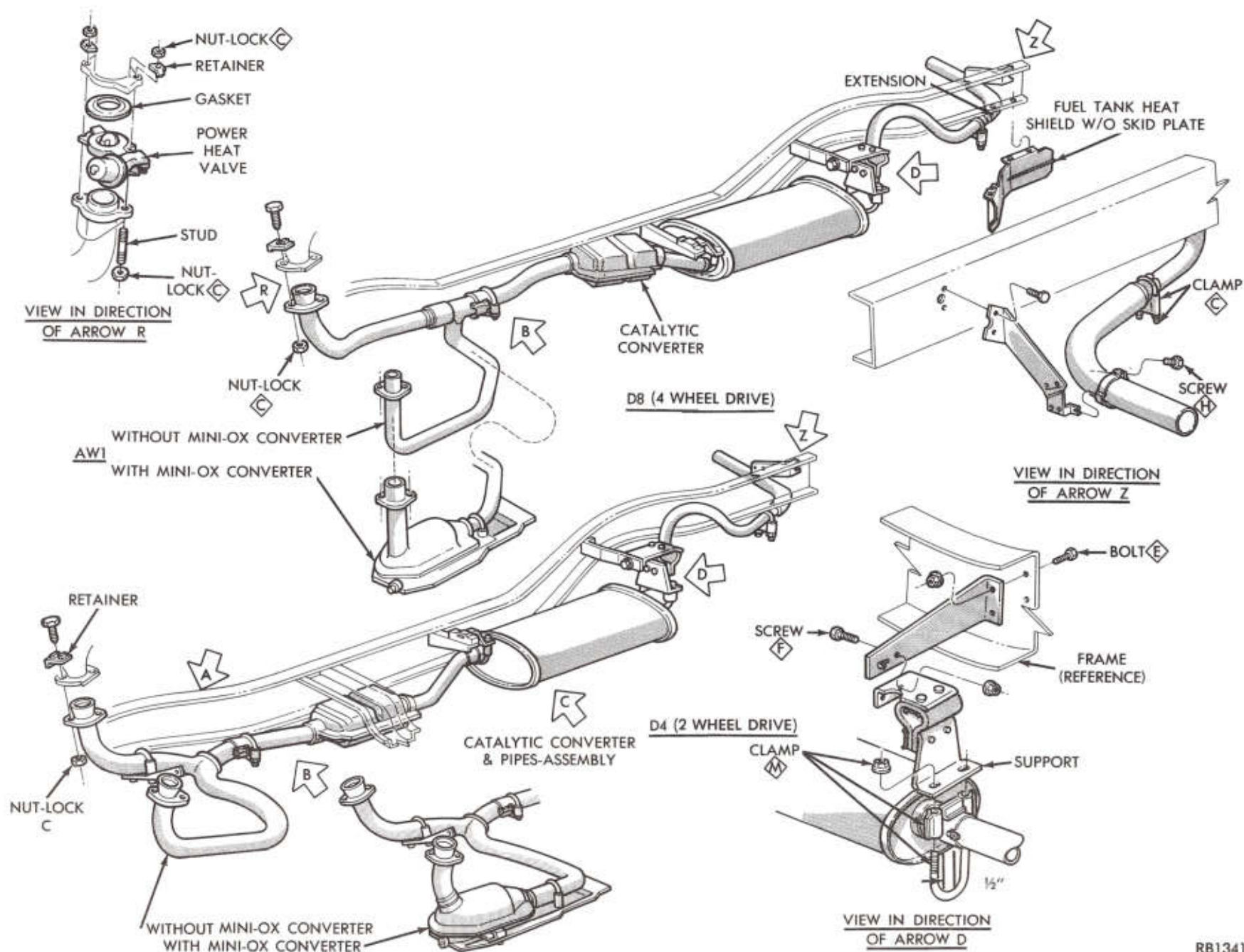


Fig. 3—Dual Exhaust System, Heavy Duty Cycle. For Views in Direction of Arrows See (Fig. 4)

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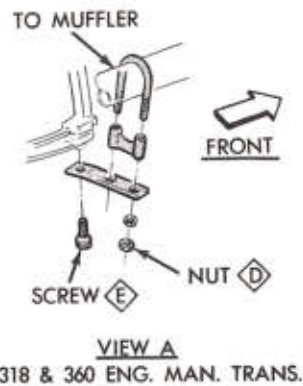
Fig. 4—System Detail for Figure 3



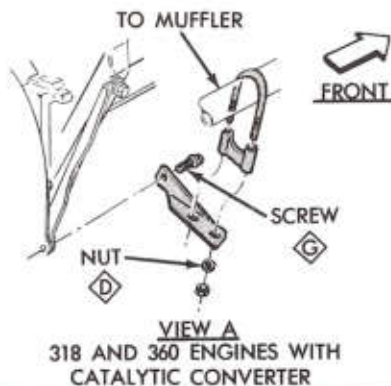
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Fig. 5—Exhaust System for Sport Utility Models with 8 Cylinder Engines. For Views in Direction of Arrows See (Fig. 6)

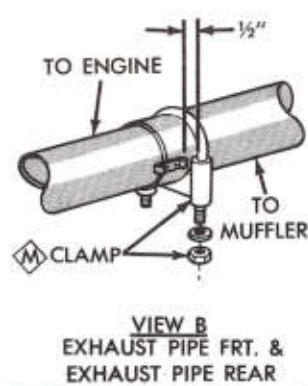
TIGHTENING TORQUE	
C	24 FT. LB. (33 N•m)
D	125 IN. LB. (14 N•m)
E	200 IN. LB. (23 N•m)
F	30 FT. LB. (41 N•m)
G	50 FT. LB. (68 N•m)
H	95 IN. LB. (10 N•m)
J	40 IN. LB. (5 N•m)
K	90 IN. LB. (10 N•m)
L	65 IN. LB. (7 N•m)
M	32 FT. LB. (43 N•m)



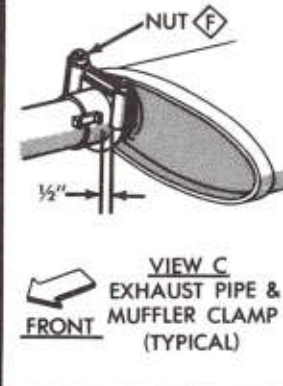
VIEW A
318 & 360 ENG. MAN. TRANS.



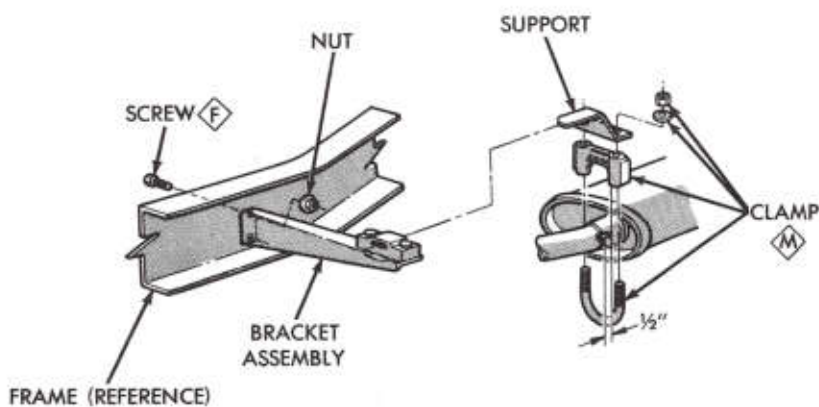
VIEW A
318 AND 360 ENGINES WITH
CATALYTIC CONVERTER



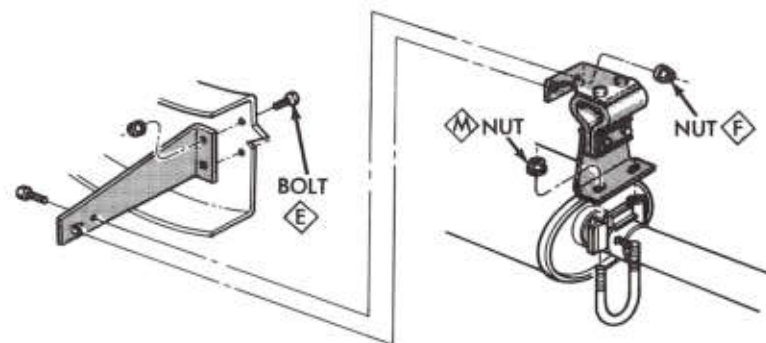
VIEW B
EXHAUST PIPE FRT. &
EXHAUST PIPE REAR



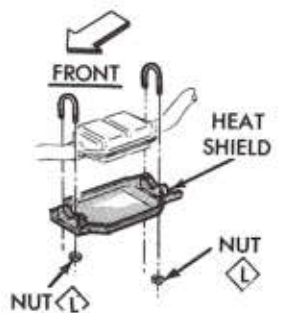
VIEW C
EXHAUST PIPE &
MUFFLER CLAMP
(TYPICAL)



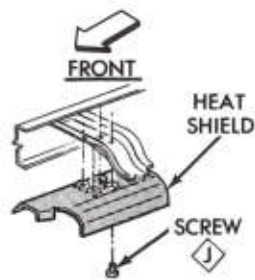
VIEW C



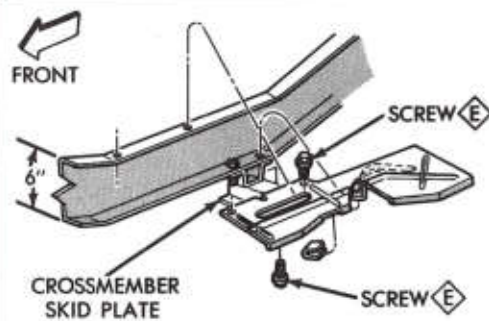
VIEW D



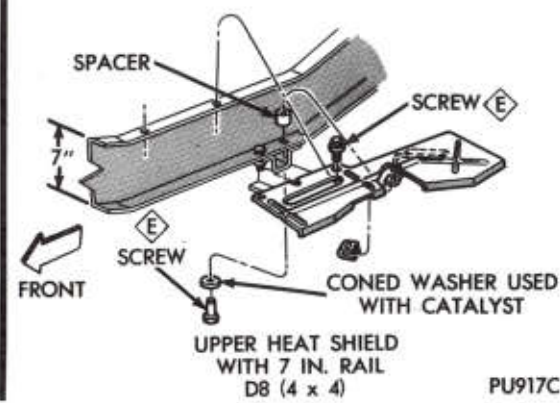
**CATALYTIC CONVERTER
LOWER HEAT SHIELD**
D8 (4 x 4)



**UPPER
HEAT SHIELD**
D4 (4 x 2)



**UPPER HEAT SHIELD
WITH 6 IN. RAIL**
D8 (4 x 4)



**UPPER HEAT SHIELD
WITH 7 IN. RAIL**
D8 (4 x 4)

PU917C

Fig. 6—System Detail for Figure 5

mixture during engine warm-up period. On all engines, when the valve is closed, the exhaust gases are directed to the heat chamber through the left side of the exhaust crossover passage; after circulating

through the heat chamber, the gases are returned to the exhaust manifold through the right side of the passage.

EXHAUST DIAGNOSIS

Condition	Possible Cause	Correction
EXCESSIVE EXHAUST NOISE	(a) Leaks at pipe joints. (b) Burned or blown out muffler. (c) Burned or rusted out exhaust pipe. (d) Exhaust pipe leaking at manifold flange. (e) Exhaust manifold cracked or broken. (f) Leak between manifold and cylinder head. (g) Restriction in muffler or tail pipe.	(a) Tighten clamps at leaking joints. (b) Replace muffler assembly. (c) Replace exhaust pipe. (d) On all engines, tighten ball joint connection attaching bolt nuts to 24 fl. lb. (33 N·m), alternate tightening. (e) Replace manifold. (f) Tighten manifold to cylinder head stud nuts or bolts to specifications. (g) Remove restriction, if possible, or replace as necessary.
LEAKING EXHAUST GASES	(a) Leaks at pipe joints. (b) Damaged or improperly installed gaskets.	(a) Tighten U-bolt nuts at leaking joints to 150 inch-pounds (17 N·m). (b) Replace gaskets as necessary.
ENGINE HARD TO WARM UP OR WILL NOT RETURN TO NORMAL IDLE	(a) Heat control valve frozen in the open position. (b) Blocked crossover passage in intake manifold.	(a) Free up manifold heat control valve using a suitable solvent. (b) Remove restriction or replace intake manifold.
HEAT CONTROL VALVE NOISY	(a) Thermostat broken. (b) Broken, weak or missing anti-rattle spring.	(a) Replace thermostat. (b) Replace spring.

SERVICE PROCEDURES

EXHAUST PIPES, MUFFLERS AND TAILPIPES

Removal (General)

(1) Raise vehicle on hoist and apply penetrating oil to clamp bolts and nuts of component being removed.

(2) Remove clamps and supports from exhaust system to permit alignment of parts during assembly.

(3) Clean ends of pipes and/or muffler to assure mating of all parts. Discard broken or worn insulators, rusted clamps, supports and attaching parts.

When replacement is required on any component of the exhaust system, it is most important that original equipment parts (or their equivalent) be used to assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

Installation (General)

(1) Assemble pipes, muffler, supports and clamps loosely to permit proper alignment of all parts.

(2) Beginning at front of system, align and clamp each component to maintain position and proper clearance with underbody parts.

(3) On ball-type connections, alternately tighten bolts to assure flanges are even and parallel.

(4) Tighten all clamps and supports to the proper torques, shown in (Figs. 1 thru 6).

CARBURETOR AIR HEATER—(If so equipped)

Air Heater—Removal (Fig. 7)

(1) Disconnect air cleaner vacuum hose from carburetor, and flexible connector between air cleaner and carburetor air heater.

(2) Disconnect crankcase inlet air cleaner to air cleaner hose. Remove air cleaner.

(3) Remove attaching screws and nuts from air heater. Remove air heater.

(4) Inspect air heater and connector tube; replace if damaged.

Air Heater—Installation (Fig. 7)

(1) Install air heater parts with attaching screws, nuts and washers, making sure all parts are in proper alignment.

(2) Install air cleaner, connect crankcase inlet air cleaner to air cleaner hose.

(3) Install flexible connector between air heater and air cleaner, and air cleaner vacuum hose from carburetor.

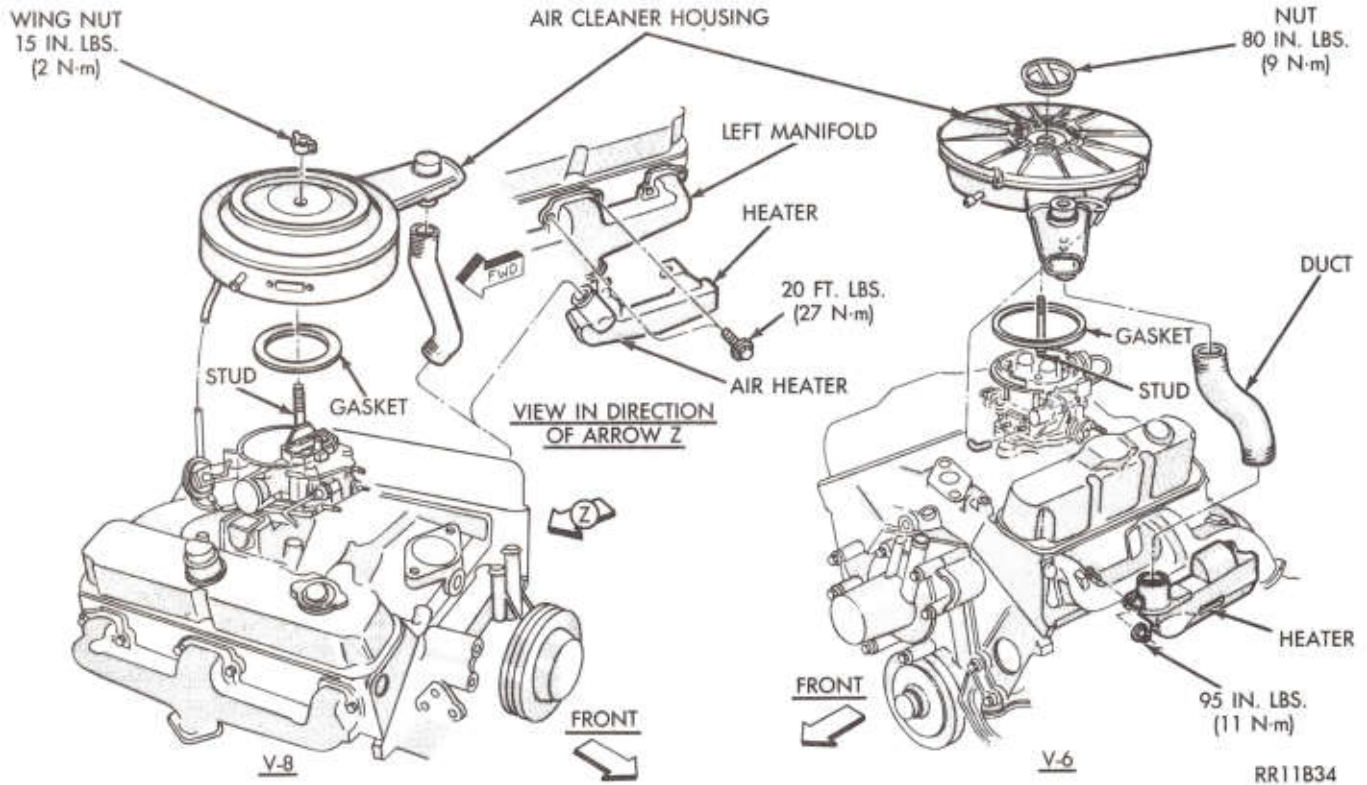


Fig. 7—Air Cleaner and Air Heater, V6 and V8 Engines

(4) Position air cleaner to provide sufficient clearance between it and air conditioning compressor, and other parts in the engine compartment.

Refer to Section 25 (Emission Control Systems) of this manual for diagnostic and service procedures on the air control valve, and temperature sensor located in the air cleaner.

INTAKE MANIFOLD (3.9L Engine)

Remove intake manifold as outlined in Group 9, "Engine"

Servicing

- (1) Clean manifold in solvent and blow dry with compressed air. Inspect manifold for cracks.
- (2) Inspect mating surfaces of manifold for flatness with a straight edge.
- (3) Inspect exhaust crossover passages through manifold. If passages are coated with hard, black carbon, they should be scraped clean and sandblasted to remove the carbon deposits.

Intake Manifold (Water Cooled) Sealing

"Right" and "Left" side gaskets are required. These steel embossed gaskets, while providing conventional sealing also provide metered coolant flow. Cutouts at

top front of each gasket (LT for left side and RT for right side) identifies each gasket position (Fig. 8).

(4) Coat intake manifold side gaskets lightly with sealer. Part Number 4318035, or equivalent.

(5) Install side gaskets to cylinder head.

(6) Clean cylinder block front and rear gasket surfaces using suitable solvent (Fig. 9).

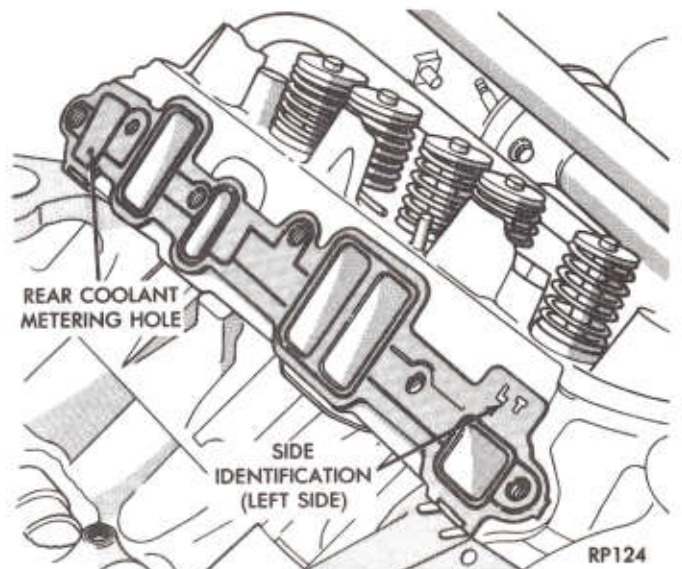


Fig. 8—3.9L Intake Manifold Side Gaskets — Left Side Shown

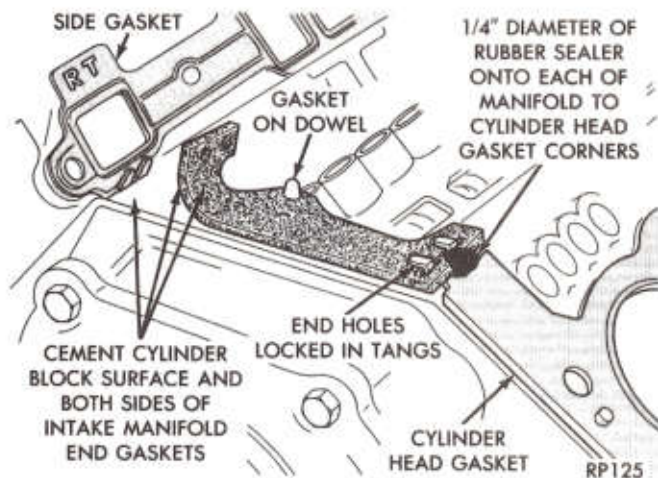


Fig. 9—Intake Manifold "End" Sealing

(7) Apply a thin, uniform coating of a quick dry cement to the intake manifold front and rear gaskets and cylinder block gasket surface.

When installing gaskets, the center hole in the gasket MUST engage dowels in block. End holes in seals MUST be locked into tangs of head gasket (Fig. 9).

(8) Carefully install the front and rear intake manifold gaskets.

(9) Place a drop (approximately 1/4" diameter) of rubber sealer Part Number 4318025 or equivalent, onto each of the **four** manifold to cylinder head gasket corners.

(10) Carefully lower intake manifold into position on the cylinder block and cylinder heads. After intake manifold is in place, **inspect to make sure seals are in place.**

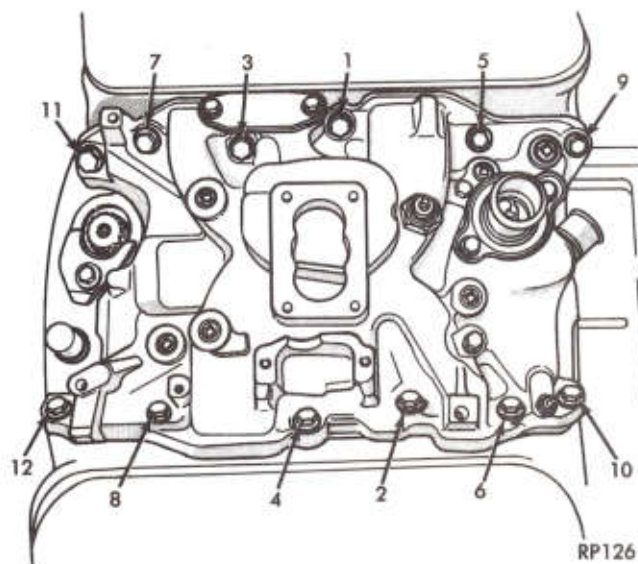


Fig. 10—3.9L Intake Manifold Screw Tightening Sequence

(11) Install the twelve attaching cap screws "Finger Tight". Tighten cap screws one through four to 25 ft. lb. (34 N·m) and tighten remaining cap screws to 25 ft. lb. (34 N·m) in the tightening sequence shown in (Fig. 7) then retighten cap screws one through four to 40 ft. lb. (54 N·m) and follow by retightening the remaining cap screws 40 ft. lb. (54 N·m) in sequence shown (Fig. 10).

EXHAUST MANIFOLD (3.9L Engine)

Removal

(1) Remove bolts and nuts attaching exhaust pipe to manifold.

(2) Remove bolts, nuts and washers attaching manifold to cylinder head. Remove manifold from cylinder head.

Cleaning and Inspection

(1) Clean mating surfaces on cylinder head and manifold, wash with solvent and blow dry with compressed air. Inspect manifold for cracks.

(2) Inspect mating surfaces of manifold for flatness with a straight edge. Gasket surfaces must be flat within .008 inch (.2mm per foot) (300mm) of length.

(3) On **Right hand** manifold, test manifold heat control valve for free operation. If necessary to free up, apply a suitable manifold heat control valve solvent to both ends of valve shaft. Be sure manifold is **COOL** and solvent is allowed to soak a few minutes to dissolve deposits. Then, work valve back and forth until it turns freely.

Installation

CAUTION: If studs came out with the nuts, install new studs, applying sealer on the coarse thread ends. If this precaution is not taken, water leaks may develop at the studs.

(1) Position two outboard arms of manifolds on the two studs on cylinder head. Install conical washers and nuts on studs (Fig. 11).

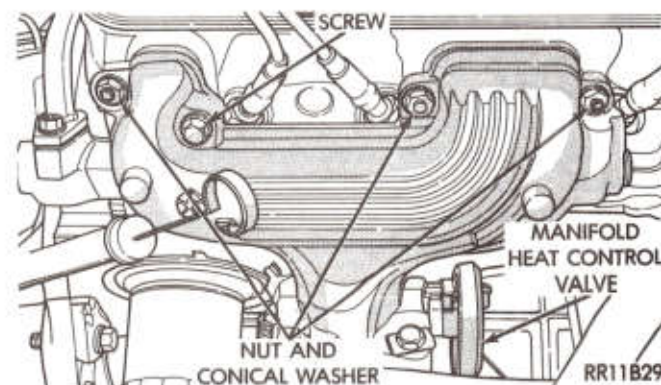


Fig. 11—3.9L Exhaust Manifold Installation (Typical) (Right Manifold Shown)

(2) Install two screws and conical washers at inner ends of outboard arms of manifold. Install two screws **without** washers on center arm of manifold (Fig. 11). Tighten screws and nuts, starting at center arm and working outward. Tighten screws to 20 ft. lbs. (27 N·m) and nuts to 15 ft. lbs. (20 N·m).

(3) Assemble exhaust pipe to manifold, and secure with bolts, nuts and washers tighten nuts to 25 ft. lb. (34 N·m).

INTAKE MANIFOLD (Eight Cylinder Engines)

Remove intake manifold as outlined in Group 9, "Engine".

Servicing

(1) Clean manifold in solvent and blow dry with compressed air. Inspect manifold for cracks.

(2) Inspect mating surfaces of manifold for flatness with a straightedge.

(3) Inspect exhaust crossover passages through manifold (Fig. 14). If passages are coated with hard, black carbon, they should be scraped clean and sand-blasted to remove the carbon deposits.

Intake Manifold (Sealing)

The 318 engine intake manifold is water cooled and requires "Right" and "Left" side gaskets. These steel embossed gaskets while providing conventional sealing also provide metered coolant flow. Cutouts at top front of each gasket (LT for left side and RT for right side) identifies each gasket position (Fig. 12). The 360 engine intake manifold gaskets are composition material.

(4) On 318 engines, lightly coat the **STEEL** intake manifold side gaskets with sealer, Part Number

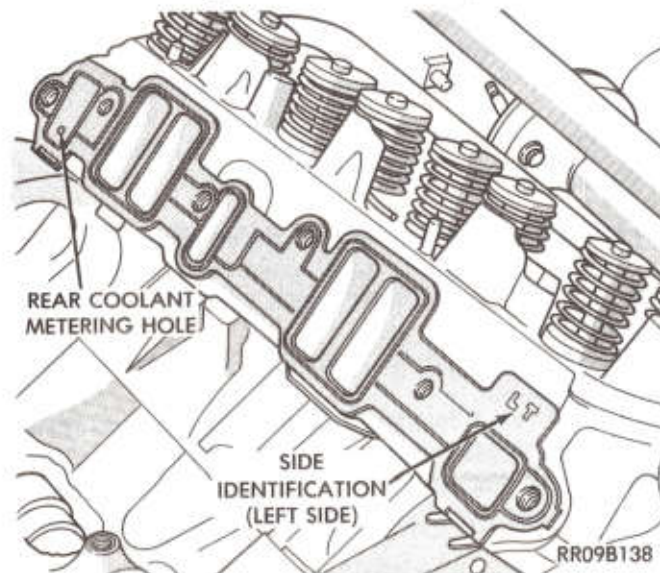


Fig. 12—318 Intake Manifold Side Gaskets (Left Side Shown)

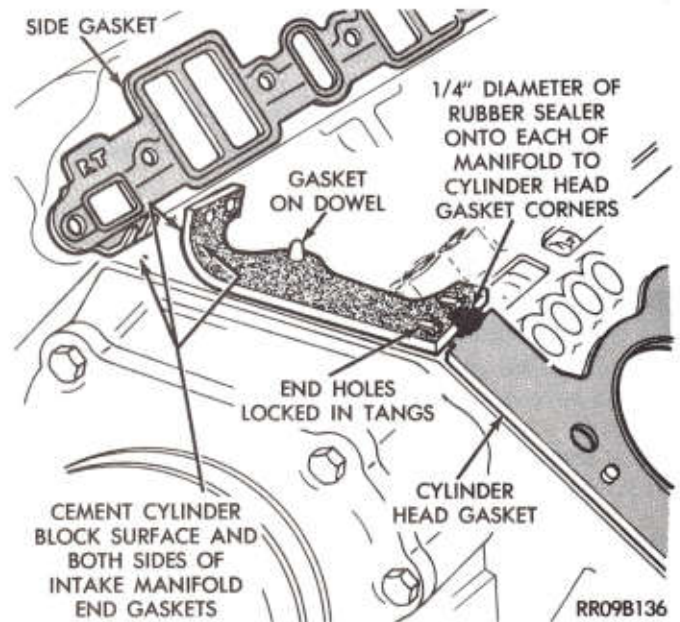


Fig. 13—Intake Manifold "End" Sealing

4310835 or equivalent. On 360 engines, **DO NOT USE ANY SEALER ON SIDE COMPOSITION GASKETS.**

(5) Install side gaskets to cylinder head.

(6) Clean cylinder block front and rear gasket surfaces using a suitable solvent (Fig. 13).

(7) Apply a thin, uniform coating of a quick dry cement such as Part Number 2299314 to the intake manifold front and rear gaskets and cylinder block gasket surface. Allow to dry 4 to 5 minutes or until tack free.

When installing gaskets, the center hole in the gasket **MUST** engage dowels in block. End holes in seals **MUST** be locked into tangs of head gasket (Fig. 13).

(8) Carefully install the front and rear intake manifold gaskets.

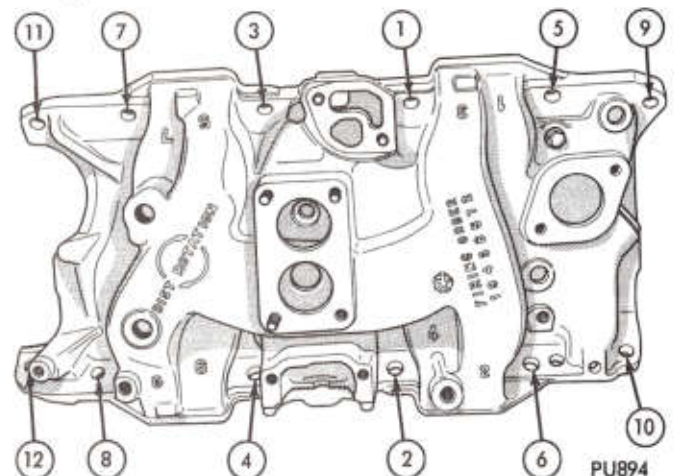


Fig. 14—Intake Manifold 318 (5.2L) and 360 (5.9L) Engines (Typical)

(9) Place a drop (approximately 1/4" diameter) of rubber seal RTV onto each of the **four** manifold to cylinder head gasket corners.

(10) Carefully lower intake manifold into position on the cylinder block and cylinder heads. After intake manifold is in place, **inspect to make sure seals are in place.**

(11) Install the twelve attaching cap screws "Finger Tight". Tighten cap screws one through four to 25 ft. lb. (34 N·m) and tighten remaining cap screws 25 ft. lb. (34 N·m) in the tightening sequence shown in (Fig. 14) then retighten cap screws one through four to 40 ft. lb. (54 N·m) and follow by retightening the remaining cap screws to 45 ft. lb. (61 N·m) in sequence shown (Fig. 14).

(12) Install exhaust manifolds and tighten screws to 20 ft. lb. (27 N·m) and nuts to 15 ft. lbs. (20 N·m).

EXHAUST MANIFOLD (Eight Cylinder Engines)

Removal

(1) Remove bolts and nuts attaching exhaust pipe to manifold.

(2) Remove bolts, nuts and washers attaching manifold to cylinder head. Remove manifold from cylinder head.

Cleaning and Inspection

(1) Clean mating surfaces on cylinder head and manifold, wash with solvent and blow dry with compressed air. Inspect manifold for cracks.

(2) Inspect mating surfaces of manifold for flatness with a straight edge. Gasket surfaces must be flat within .008 inch (.2mm) per foot (300mm) of length.

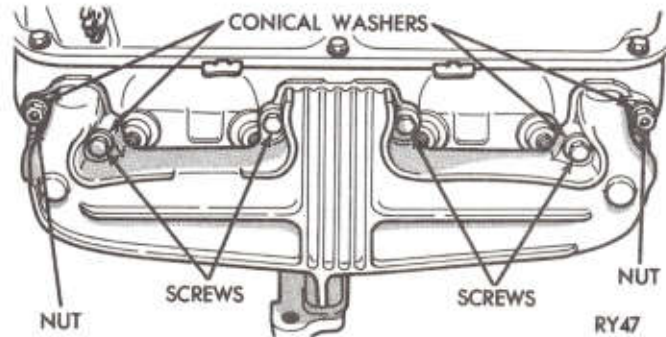
(3) On **right hand** manifold, test manifold heat control valve for free operation. If necessary to free up, apply a suitable manifold heat control valve solvent to both ends of valve shaft. Be sure manifold is **COOL** and solvent is allowed to soak a few minutes to dissolve deposits. Then, work valve back and forth until it turns freely.

Installation

CAUTION: If studs came out with the nuts, install new studs, applying sealer on the coarse thread ends. If this precaution is not taken, water leaks may develop at the studs.

(1) Position two outboard arms of manifolds on the two studs on cylinder head. Install conical washers and nuts on studs (Fig. 15).

(2) Install two screws and conical washers at inner ends of outboard arms of manifold. Install two screws **without** washers on center arm of manifold (Fig. 15). Tighten screws, starting at center arm and working outward, to 20 ft. lb. (27 N·m). Tighten nuts to 15 ft. lbs. (20 N·m).



**Fig. 15—Exhaust Manifold Installation (Typical)
(318 Engine Shown)**

(3) Assemble exhaust pipe to manifold, and secure with bolts, nuts and washers and tighten nuts to 25 ft. lb. (34 N·m).

MANIFOLD HEAT CONTROL VALVE

Operation of the manifold heat control valve should be inspected periodically. With engine idling, accelerate momentarily. On all engines, the counterweight should move **clockwise**. If no movement is observed, shaft is binding due to accumulation of deposits or thermostat spring is weak or broken.

The application of a suitable manifold heat control valve solvent every oil change, to both ends of manifold heat control valve shaft at bushings, will keep valve working freely. The solvent should be applied when manifold is **COOL** and allowed to soak a few minutes to dissolve deposits. Then, work valve back and forth until it turns freely.

(Remove right exhaust manifold as indicated in this section).

Removal of Heat Control Valve

(1) Position valve, plate, grind off spot welds from valve plate and shaft.

(2) Remove counterweight and shaft assembly valve plate.

(3) Press out bushings and seals from manifold.

(4) Inspect vent holes and clean out if necessary.

Installation of Heat Control Valve (Fig 16)

(1) Press in cup seals until seals extend into manifold .100 inch on each side with cupped ends facing outward.

(2) Press in bushings flush with outer edge of exhaust manifold.

(3) **Line ream bushings and seals no less than .3095 inch (7.8163mm) or no more than 3.110 inch (7.8994mm) diameter. Test for free fit of shaft in bushings and seals. Do not use 5/16 inch (7.9mm) reamer.**

(4) Install valve stop in slot on counterweight so looped ends face outward, away from the counterweight shaft hole.

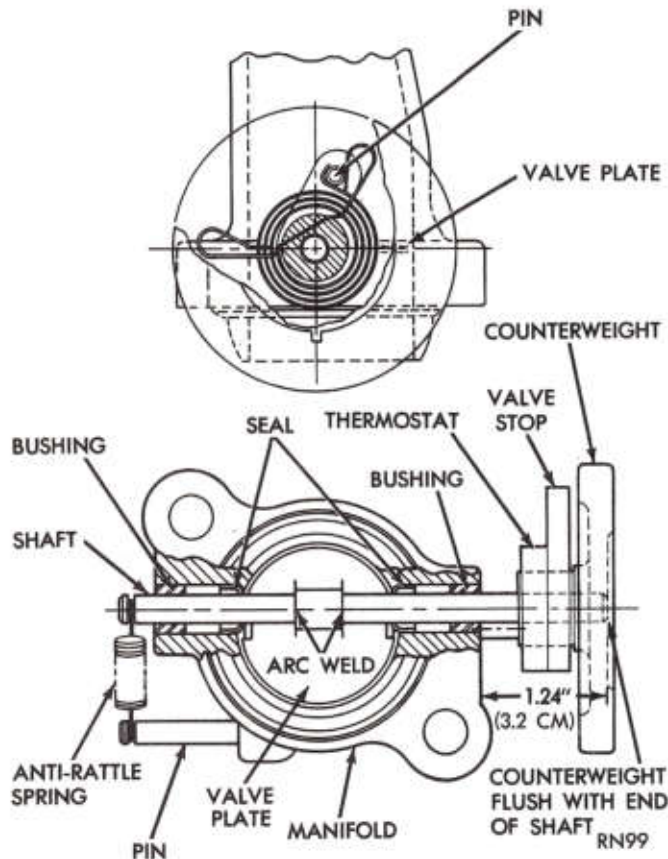


Fig. 16—Manifold Heat Control Valve

(5) Position thermostat so center end or tab is pointing left and hook or outer end points down, install thermostat on counterweight.

(6) Mark one end of shaft with a suitable dye at 1.240 inches (3.2cm), press counterweight on marked end of shaft until flush with end of shaft.

(7) Holding thermostatic spring wrapped 140 degrees in a counterclockwise direction viewed from counterweight end, install shaft assembly through outer bushing, seal and valve plate with center strap facing flange end of manifold; attach hook end of thermostatic spring to stop pin.

(8) With counterweight end of shaft positioned 1.240 inches (3.2cm) (previously identified) away from manifold, valve plate centered between seals and valve plate closed, arc weld valve plate to shaft with stainless steel rod. Arc welding ground must be made at counterweight.

(9) Test for free operation. Install anti-rattle spring.

(10) Position new gasket on studs, install exhaust manifold and tighten to 20 ft. lb. (27 N·m).

(11) Install exhaust pipe to manifold (no gasket used) and tighten to 24 ft. lb. (33 N·m).

TIGHTENING REFERENCE

	Ft. Lbs.	In. Lbs.
Exhaust Manifold to Cylinder Head Stud Nut		
All Engines	15 (20 N·m)	
Exhaust Manifold to Pipe Flange Ball Joint Bolt Nut	24 (33 N·m)	
Exhaust Pipe Flange Bolt Nut Single Exhaust	24 (33 N·m)	
Dual Exhaust	24 (33 N·m)	
Exhaust Pipe U Bolt Nut		150 (17N·m)
Intake Manifold to Cylinder Head Screw	35 (47 N·m)	
All Engines		
Rear Muffler Support Bolt and Nut		200 (23 N·m)
Rear Muffler Support to Underbody Bolt		200 (23 N·m)
Support Clamp Screw		95 (11 N·m)
Tail Pipe Support to Underbody Bolt		200 (23 N·m)

FRAME STRUCTURES

CONTENTS

	Page		Page
GENERAL INFORMATION	1	SPECIFICATIONS	11
INSPECTION PROCEDURES	1	TIGHTENING REFERENCE	11
SERVICE PROCEDURES	10		

GENERAL INFORMATION

The main function of the truck frame is to provide support for all chassis components, body mounting and to carry the payload while keeping deflections at a tolerable level.

The frame is a complex structural mechanism which reacts to applied loads and road inputs by bending and twisting. The main bending members are the siderails. Resistance to frame twist is provided by crossmembers which are rigidly attached to the siderails with either rivets or bolts to form the so-called "ladder type" frame (Figs. 1 thru 4).

Frame Siderail Material

Carbon steel with a minimum yield strength of 32000 psi is used to fabricate the light and the medium duty truck frame siderails.

Since the yield strength for the same steel can vary considerably it has been Dodge's practice to specify the minimum yield strength. Thus the 32000 psi minimum frame has in reality a range of 32000 to 44000 psi with a typical average value of 38000 psi.

For severe applications, high strength steel frame siderail reinforcements of the same steel are used.

Frame Load-Carrying Capacity

Since by far the most important factor of frame action is its flexing, it is customary to compare the frames by their "Resisting Bending Moment" (R.B.M.), term denoting the maximum bending the siderails can safely withstand.

The resisting bending moment can be used for quick

comparison of frames having different rail configuration and materials.

The Resisting Bending Moment consists of two terms: Section Modulus and Material Yield Strength.

(Section Modulus x Yield Strength = R.B.M.)

The greater the section modulus and the higher the yield strength, the stronger the siderails.

The term Section Modulus pertains to the cross-section of the siderail and is determined by rail depth, flange width, and material thickness.

Yield strength is a measurement in psi of stress at which a material exhibits a specified permanent deformation.

Frame Type

Light Duty Truck and Sport Utility frames are of a ladder type with drop center section channel siderail and crossmembers. Crossmembers are riveted or bolted to the frame. Body support and suspension mounting brackets are riveted to siderails. (See Figs. 6, 7, and 8 for inch dimensions.)

D150-350 frames are designed to accommodate independent front suspension with the suspension crossmember as a part of the frame assembly as are engine front mounting brackets which are welded to the suspension crossmember and riveted to the siderail.

AW150 and W150-350 (four-wheel-drive vehicles) frames are basically the same, except front suspension crossmember is replaced with a smaller engine support crossmember.

INSPECTION PROCEDURES

INDEX

	Page		Page
Dimensions	7	Inspection	6
General Information	1	Measurements	6

GENERAL INFORMATION

Improper frame alignment is usually a result of an accident or vehicle being operated with excessive loads or with loads not positioned in a reasonably

distributed manner.

A distorted frame will affect front wheel or rear axle alignment and cause excessive wear, mechanical

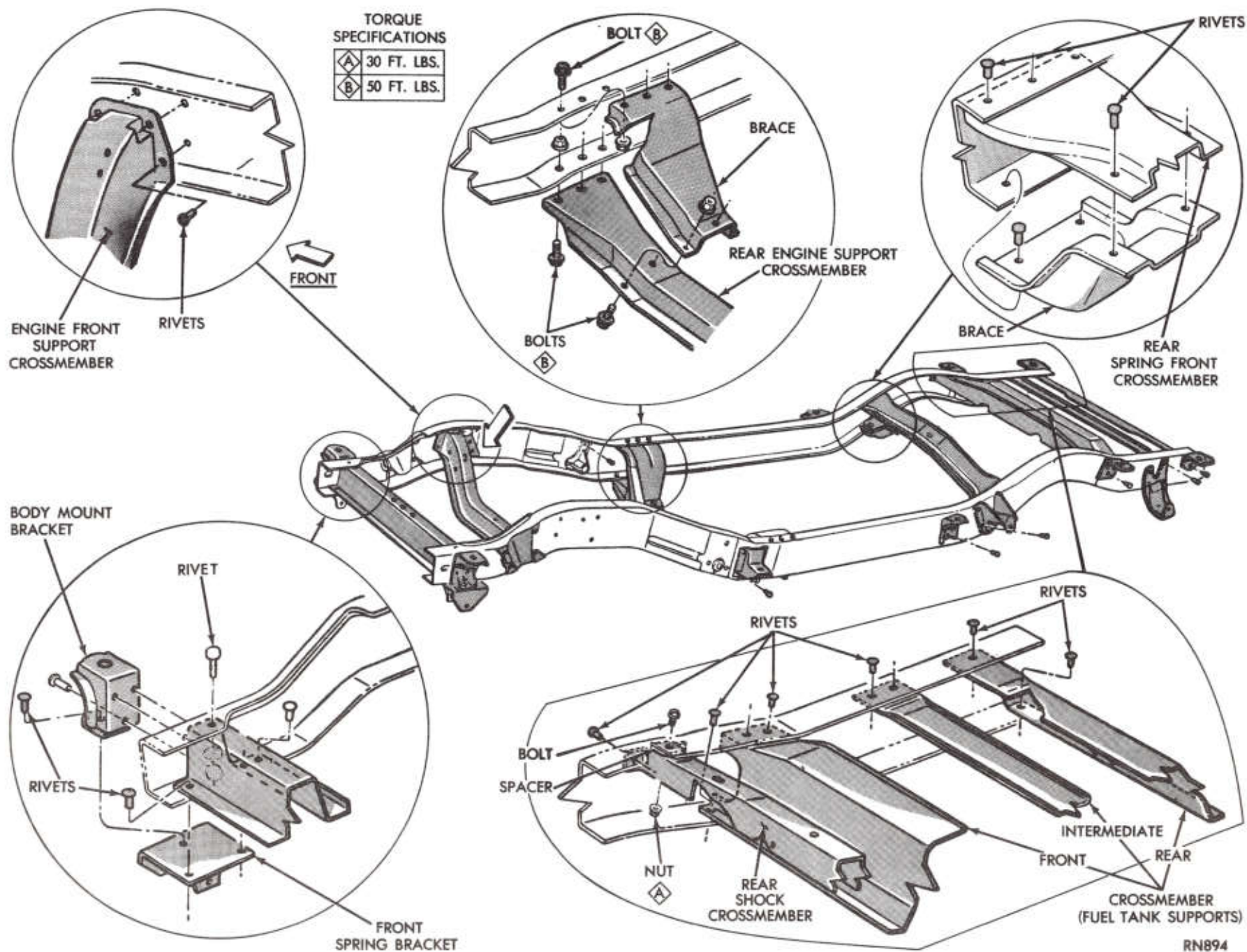


Fig. 1—AW1 Frame Structure with Body Mount and Spring Hanger Brackets

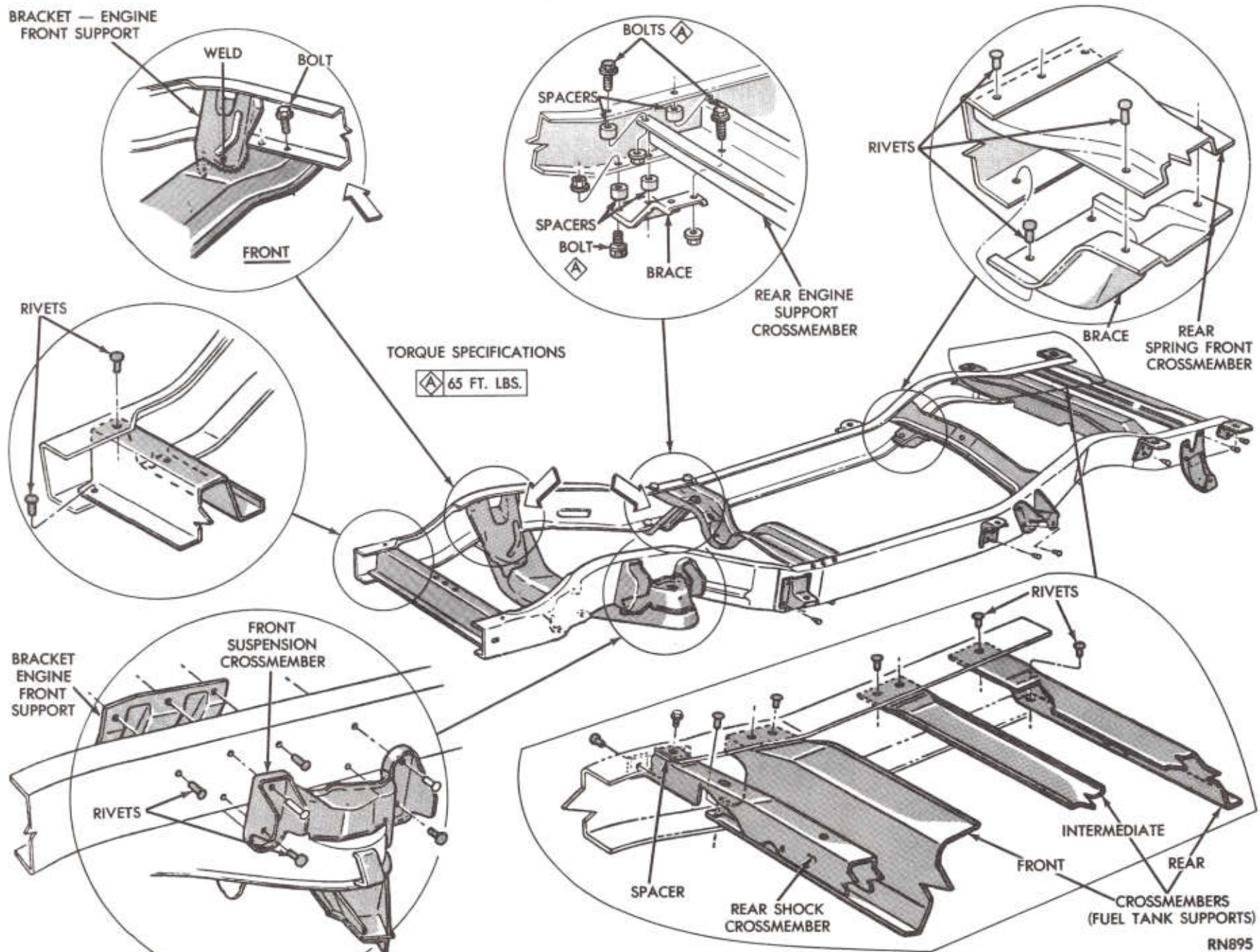
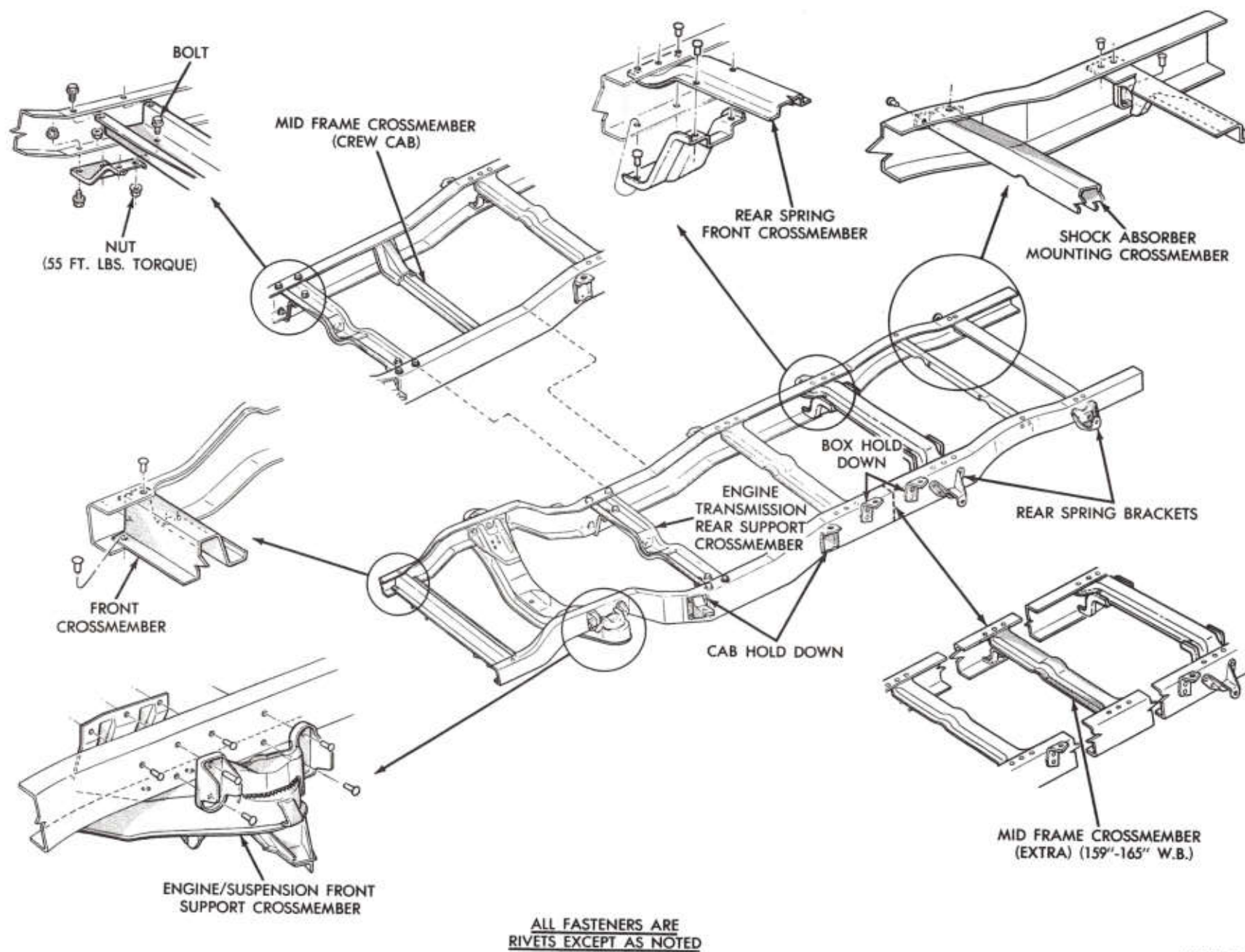
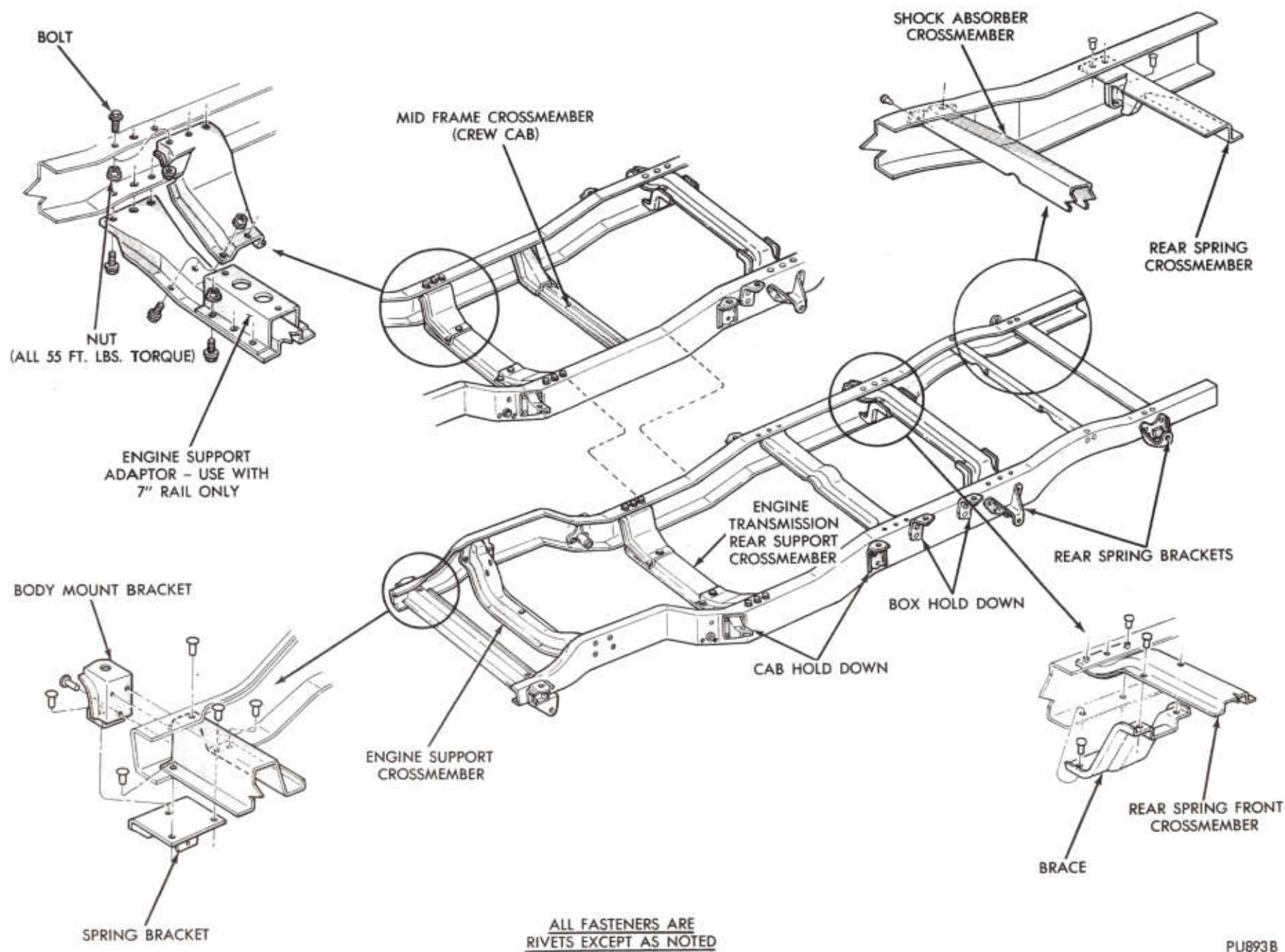


Fig. 2—AD1 Frame Structure with Body Mount and Suspension Brackets



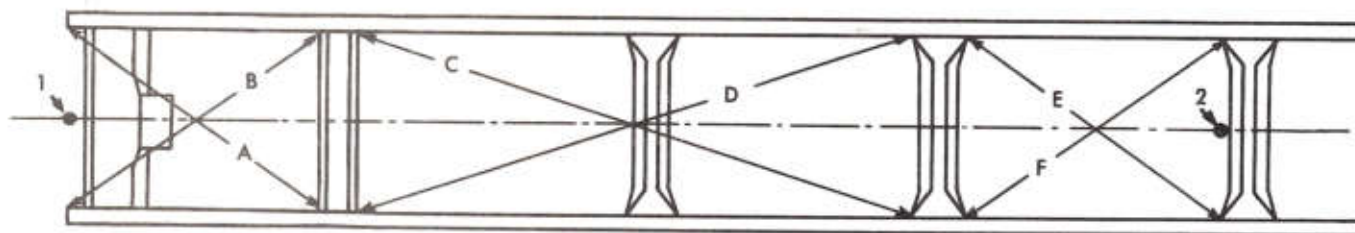
PU892C

Fig. 3—D100 through D350 Frame Structure



PU893B

Fig. 4—W150 through W350 Frame Structure



RN888

Fig. 5—Alignment Markings

failures in power train, window glass cracks and door opening problems. Vehicle performance, handling and ride quality can be impaired.

INSPECTION

Before proceeding with frame alignment checks, inspect all frame parts for visible damage such as cracks, twists, bends, or other excessive deformations. Also, riveted, bolted, or welded connections, looseness or missing parts.

All damaged areas must be repaired or parts replaced as necessary.

Horizontal or Diagonal

Determine frame deviation from being square by the following procedure:

- (1) Select several points along one siderail, preferably at crossmember locations.
- (2) Transfer these with a plumb bob to floor, paper sheets can be fastened to floor at these points for better accuracy.
- (3) Locate corresponding points on other siderail and transfer them in the same manner to the floor.
- (4) Move truck away and measure between all points diagonally and parallel to siderails, corresponding measurements should not differ by more than 1/4 inch.
- (5) Take measurement across at front and rear marks and by dividing distances in half, indicate the two points on floor.
- (6) Stretch a chalk-line between points 1 and 2 in Fig. 5 and snap string.
- (7) Check to see how close centerline is to diagonal intersection points A, B, C, D, E, and F in Fig. 5.
- (8) Markings on floor will now give an indication of frame distortion in plain view.
- (9) Any point on one siderail should be within 1/8

inch ahead or behind corresponding point on opposite side.

(10) Frame bow sideways should not exceed 1/8 inch per 100 inch length of frame.

(11) Overall width of frame should not vary more than 1/8 inch.

(12) Repeat steps (1) through (11) after straightening frame.

Vertical or Sideview

Determine twist of frame and degree of siderails not being parallel to one another as follows:

Vertical dimensions are measured from a level floor to corresponding points on left and right siderails. Dimensions should then be plotted to scale vertical and horizontal on a sheet of paper and points connected for each sidemember separately. Graph will show the relative position of the sidemembers.

Points on siderail or for horizontal check are selected at rear frame crossmembers and any one of these points on one sidemember should be maximum 1/8 inch above or below corresponding point on other siderail.

MEASUREMENTS

Obtain measurements for frame alignment checks with the body on vehicle. Figures 6, 7, and 8 as identified, indicate dimensions in chosen areas to determine frame alignment. The procedures are recommended as follows:

- (1) Place vehicle on level floor.
- (2) If vehicle is loaded, make sure payload does not exceed specified limit and the load is distributed as evenly as possible. For better accuracy of measurements, all payload should be removed.
- (3) Check tires for recommended air pressure and adjust as necessary.

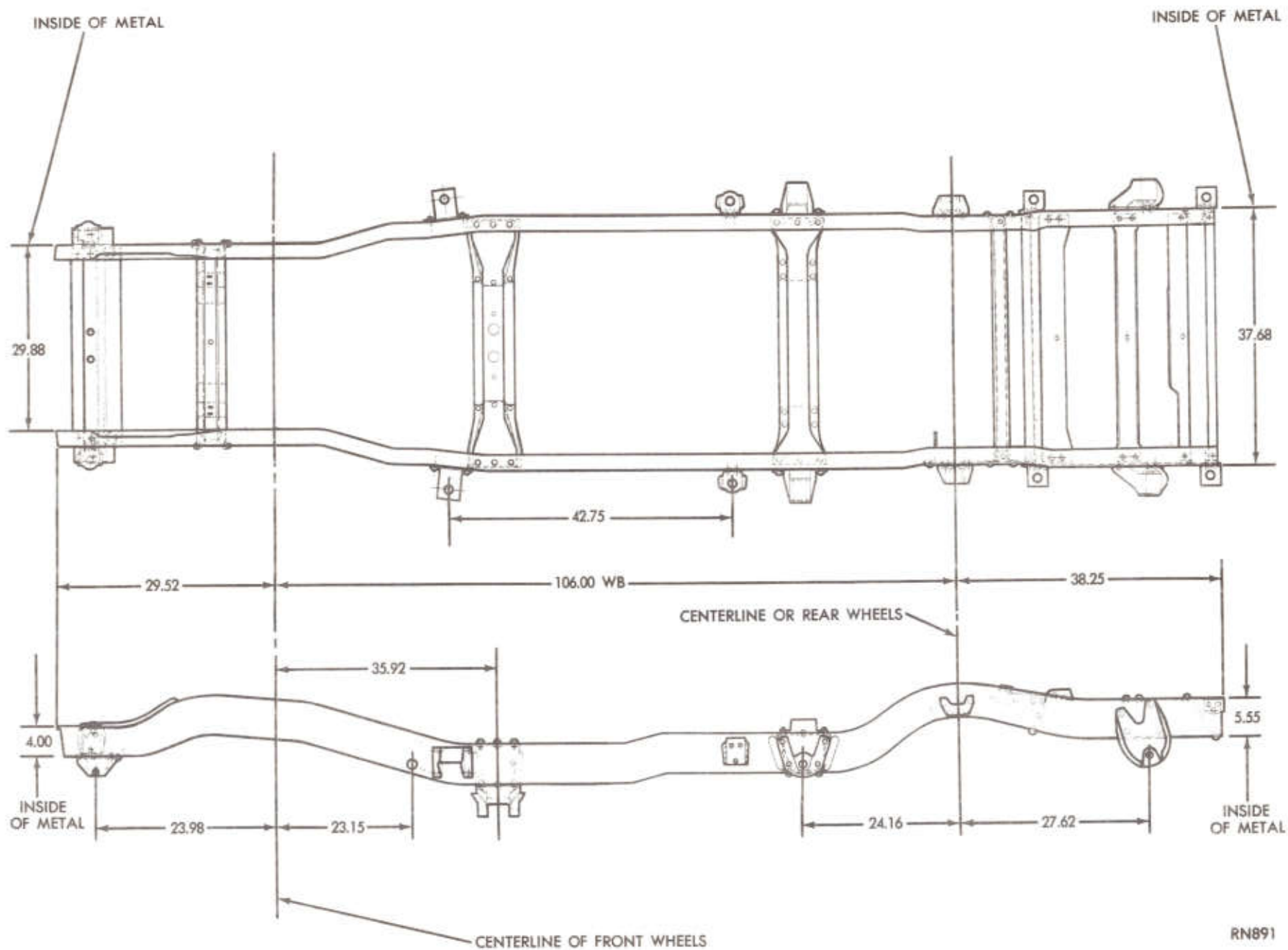


Fig. 6—Frame Dimensions (Sport Utility)

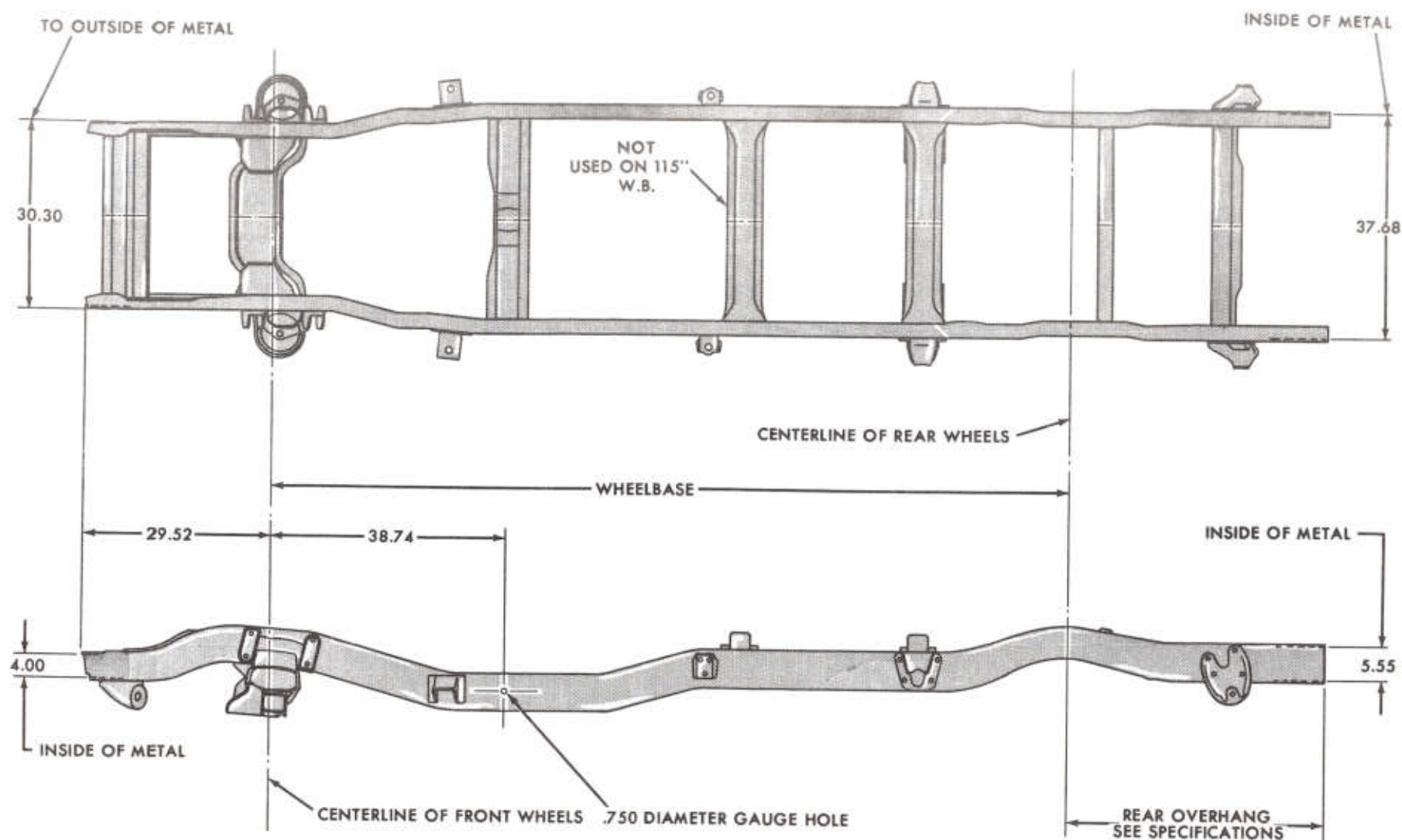
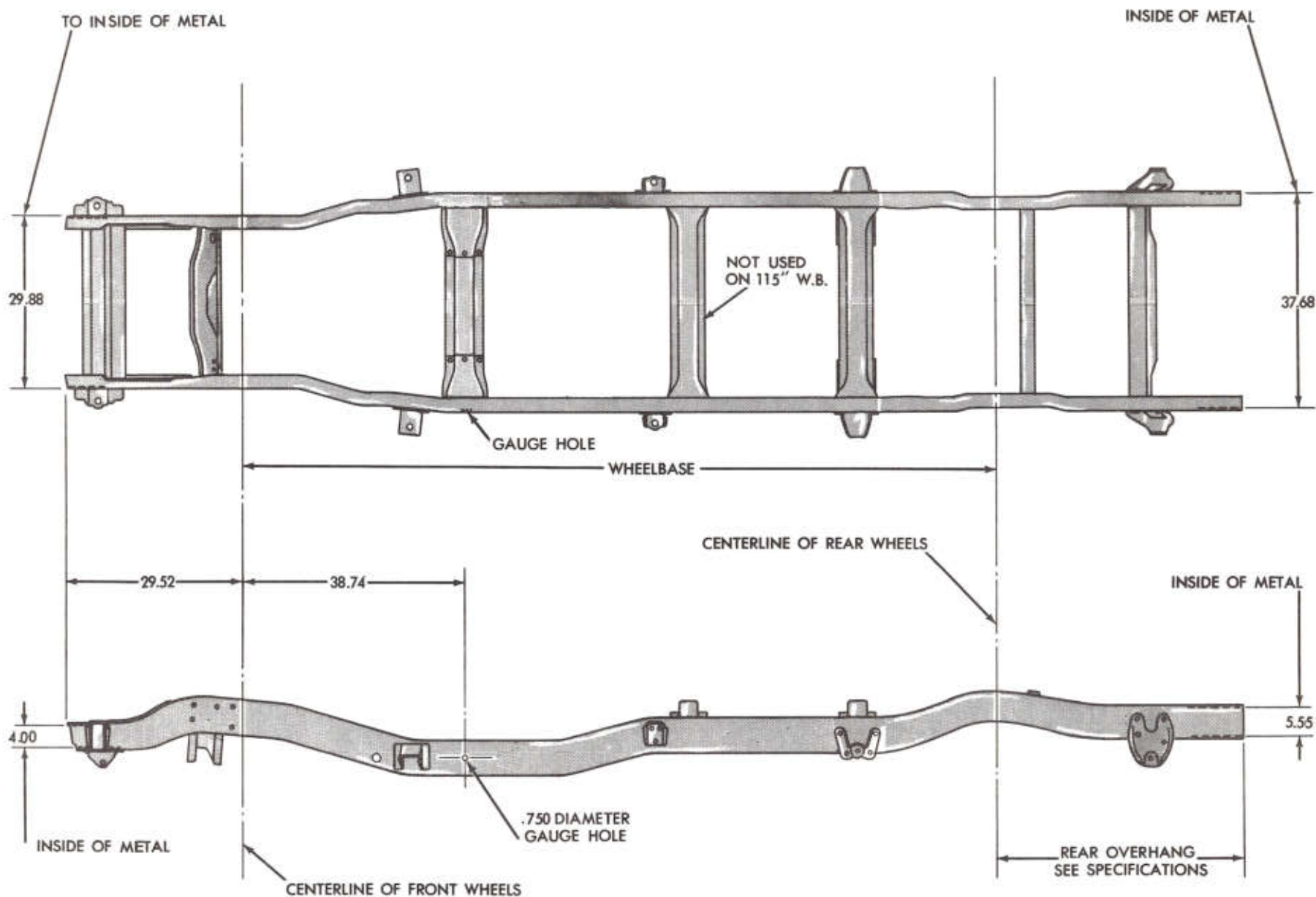


Fig. 7—Frame Dimensions (D150 through D350)



RN890

Fig. 8—Frame Dimensions (W150 through W350)

SERVICE PROCEDURES

INDEX

General Information	Page 10	Repairing	Page 10
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GENERAL INFORMATION

Frames which are bent or twisted can be straightened, if necessary, by heat application. The temperature is to be kept under 1050F. (a dull red glow) as excessive heat will impair the strength of the material, resulting in a weakened frame.

This heat method is permissible on Light and Medium duty frames only. Damaged frame rails, crossmembers and brackets can be repaired by straightening or replacing.

Welded connections between rails and crossmembers are not recommended.

Straightening

Straightening should be limited to parts not severely damaged. New bolts or rivets for attaching the parts should be of same specifications as original bolts or rivets.

Replacement

Replacement is recommended as the original shape of the part may not be easily recognizable. Also, improperly straightened frame components will have harmful effects on alignment.

REPAIRING

Drilling

No holes should be drilled in siderail flanges as this will reduce frame strength. Holes drilled in siderail vertical web must be 1-1/2 inches minimum from top and bottom flanges.

New holes should be located a distance away from existing holes, as not to reduce cross section of siderails in any one vertical section by more than 30%.

Welding

Welding of siderails and crossmembers should be done, preferably, with electric welding equipment as

it retains heat in a small area limiting the change of hardness of metal.

A damaged frame member is to be closely inspected for cracks. It is possible that cracks will appear as a result of straightening of a member. In either case, crack or cracks are to be repaired as follows:

- (1) Stop-drill at the end point of the crack with 1/8 inch drill.
- (2) V-groove crack to allow good weld penetration.
- (3) Weld up the crack.
- (4) Grind surface smooth if reinforcement is to be used.

Use of Fasteners

Bolts or rivets can be used in repairing frames or adding reinforcement. When it is more practical to substitute a bolt for a rivet, use next larger size bolt to prevent bolt from working loose. Ream holes if necessary.

Coned washers are preferred to split lock type. Generally Grade 5 bolts will suffice in repair work. Grade 3 bolts should be avoided. Proper torque is mandatory to provide adequate locking and preclude loosening of fasteners. Refer to the Specifications chart for bolt grades and torques.

Reinforcing

Reinforcement can be made from channel, angle or flat stock of common carbon steel and approximately equal in thickness to the part to be repaired. It is not possible to recommend proper reinforcement for all repairs. A reinforcement should provide an adequate section in cracked area and have sufficient overlap with the original part and be properly attached.

Reinforcing channel should have flanges shorter than sidemember flanges to preclude welding along edge of rail flange. Otherwise, longitudinal welds are quite acceptable. Complete transverse welds are to be avoided.

SPECIFICATIONS

Values of the section modulus, yield strength and R.B.M. are shown for each siderail in the following tables.

LIGHT DUTY MODELS

Model	Wheel Base	Depth	Siderail Section		Section Modulus	R.B.M.*		Rear Overhang
	Inch (cm)	Inch (cm)	Flange	Gage	Inch (cm)	Inch Pounds (kg)		Inch (cm)
CONVENTIONAL CAB								
D150	115 (292)	6.06 (15)	2.27 (6)	.156 (.396)	2.86 (7.26)	91520 (41513)		38.25 (97.15)
D150	131 (332)	6.06 (15)	2.27 (6)	.156 (.396)	2.86 (7.26)	91520 (41513)		42.25 (107.31)
D250-350 thru 8510 GVW	131 (332)	6.17 (16)	2.32 (6)	.210 (.533)	3.88 (9.86)	124160 (56319)		42.25 (107.31)
D350—10,000 GVW	131 (332)	7.20 (18)	2.73 (7)	.194 (.493)	5.02 (12.75)	160640 (72866)		42.25 (107.31)
D350	135 (342)	7.20 (18)	2.73 (7)	.194 (.493)	5.02 (12.75)	160640 (72866)		42.25 (107.31)
D350	159 (404)	7.31 (18)	2.79 (7)	.250 (.635)	6.56 (16.66)	160640 (72866)		48.25 (122.55)
W150	115 (292)	6.12 (18)	2.30 (6)	.188 (.477)	3.43 (8.71)	109760 (49787)		38.25 (97.15)
W150-250-350	131 (332)	6.17 (18)	2.32 (6)	.210 (.533)	3.88 (9.86)	124160 (56319)		42.25 (107.31)
W350	135 (318)	7.20 (18)	2.73 (7)	.194 (.493)	5.02 (12.75)	160640 (72866)		48.25 (122.55)
SPORT UTILITY								
AD1	106 (269)	6.06 (15)	2.27 (6)	.156 (.396)	2.86 (7.26)	91520 (41513)		38.25 (97.15)
AW1	106 (269)	6.06 (15)	2.27 (6)	.156 (.396)	2.86 (7.26)	91520 (41513)		38.25 (97.15)

*Resisting Bending Moment based on 32000 psi minimum yield strength of siderail steel.

TIGHTENING REFERENCE

Torque in Ft.-Lbs. (N.m)

Bolt Size	Grade 5		Grade 8	
3/8 x 16	20-40	(27-54)	30-50	(41-68)
3/8 x 24	25-45	(34-61)	30-60	(41-81)
7/16 x 14	35-65	(47-88)	50-80	(68-108)
7/16 x 20	40-70	(54-95)	60-90	(81-122)
1/2 x 13	55-95	(75-129)	80-120	(108-163)
1/2 x 20	65-105	(88-142)	85-135	(115-183)
9/16 x 12	80-130	(108-166)	110-160	(149-217)
9/16 x 18	90-140	(122-190)	125-175	(169-237)

FUEL SYSTEM

CONTENTS

	Page		Page
ACCELERATOR PEDAL AND THROTTLE CONTROLS	19	FUEL TANKS	9
DRIVEABILITY SYMPTOM DIAGNOSIS	48	GENERAL INFORMATION	1
ELECTRONIC FUEL INJECTION		ROCHESTER QUADRAJET® CARBURETOR ...	56
3.9L AND 5.2L ENGINE	21	SERVICING THE CARBURETOR	55
FUEL DELIVERY SYSTEM	2	SPECIFICATIONS	81

GENERAL INFORMATION

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the breakdown of these designations is included in the Introduction Section at the front of this service manual.

The Fuel System consists of the fuel tank, fuel pump, fuel filter, throttle body, carburetor, fuel injectors, fuel lines and vacuum lines.

The **Fuel Delivery System** consists of the fuel pump, fuel filter, fuel lines and fuel hoses.

The **Fuel Tank Assembly** consists of the fuel tank, filler tube, a fuel gauge sending unit assembly, electric fuel pump 3.9L and 5.2L engines and a pressure-vacuum filler cap.

Also, to be considered part of the fuel system is the **Evaporation Control System**, which is designed to reduce the emission of fuel vapor into the atmosphere and the **Electric Choke System**, which helps to reduce HC and CO emissions during engine warm up.

The description and function of the Evaporation Control System is found in Group 25 of this manual.

Fuel Usage

Your vehicle was designed and developed for optimum operating performance and efficiency using gasoline.

In order to retain the optimum performance qualities and enjoy trouble-free operation of your vehicle, it is recommended that only gasolines from reputable dealers be used.

Use unleaded gasolines having a minimum octane rating of 87, (R+M)/2.

Unsatisfactory fuels particularly those having excessive volatility, can cause problems such as hard starting, stalling and driveability deterioration. If problems are experienced, it is recommended that another brand of gasoline be used prior to considering service for the vehicle.

In addition to choosing the proper octane rating, use of gasolines containing a high level of detergent additives is also recommended. The use of these high detergent gasolines will reduce intake system deposit build-up and maintain the excellent driveability of your vehicle.

Vehicles Equipped With Catalytic Converters

Unleaded gasolines only must be used in vehicles equipped with catalyst emission control systems. All vehicles so equipped have labels located on the instrument panel and adjacent to the fuel filler cap or door that state **UNLEADED FUEL ONLY**. These vehicles also have fuel filler tubes especially designed to accept only the small diameter unleaded gasoline dispensing nozzles.

The exhaust emission system of your vehicle is designed to meet all emission regulations while, at the same time, providing excellent fuel economy. Catalyst systems require that only unleaded gasoline be used. Use of leaded fuel will not only destroy the effectiveness of the catalytic converter used to reduce exhaust emissions, but will also make part of the fuel control system inoperative and lead to high fuel consumption.

Vehicles Not Equipped With Catalytic Converters

Vehicles not equipped with catalyst emission control systems may be operated on either leaded or unleaded gasolines.

Gasolines Containing Alcohol

Your vehicle was designed and developed for optimum operating performance and efficiency using gasoline. Gasoline/alcohol blends are also sold as motor vehicle fuel.

The type and amount of alcohol used in the blend are important. Many states require gasoline stations to display the type and the amount of alcohol contained in the gasoline/alcohol blend on the pump. If your state does not have this requirement, we recommend that you ask the gasoline station operator if their fuel contains alcohol and if so, what type and amount his fuel contains.

The following two types of alcohols are generally used in gasoline blends:

Ethanol — (Ethyl or Grain Alcohol) is used as a mixture of 10% Ethanol and 90% unleaded gasoline. These fuel blends are usually identified at the pump as "ethanol enhanced", "contains ethanol" or "gasohol". Gasoline blended with ethanol, may be used in your vehicle. Note that these blends, due to their

generally higher volatility, may adversely affect the starting, driveability and fuel efficiency of your vehicle. If problems are experienced with ethanol/gasoline blends, it is recommended that the vehicle be operated on gasoline.

Methanol—(Methyl or Wood Alcohol) is used in a variety of concentrations blended with unleaded gasoline. You may encounter fuels containing between 3% and 12% Methanol along with 3% to 5% other alcohols called cosolvents.

Do not use gasolines containing Methanol.

Use of Methanol gasoline blends may result in starting and driveability deterioration and damage to

critical fuel system components.

Fuel system damage and vehicle performance problems resulting from the use of gasolines containing Methanol are not the responsibility of Chrysler Motors and may be not covered by the new vehicle warranty.

Materials Added to Fuel

Indiscriminate use of fuel system cleaning agents should be avoided. Many of these materials intended for gum and varnish removal may contain active solvents or similar ingredients that can be harmful to gasket and diaphragm materials used in fuel system component parts.

FUEL DELIVERY SYSTEM

INDEX

Electric Fuel Pump System	Page 5	Mechanical Fuel Pump System	Page 2
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MECHANICAL FUEL PUMP SYSTEM

INDEX

Fuel Filter	Page 2	Fuel Pump	Page 4
Fuel Filter Vapor Separator	2, 4	Installation	4
Removal	4	Removal	4
Installation	4	General Information	2
Fuel Hoses and Clamps	3	Service Diagnosis	3
		Service Procedure	3
		Testing Fuel Pump (On Vehicle)	3

GENERAL INFORMATION

The fuel pumps are driven by an eccentric cam that is a pressed steel eccentric cam mounted on the gear end of the camshaft in the 360 cubic inch engine.

As the camshaft rotates, the eccentric cam presses down on the pump rocker arm. This action lifts the pull rod and diaphragm upwards against the fuel pump main spring, creating a vacuum in the valve housing and opens the inlet valve and fuel is drawn into the valve housing chamber. On the return stroke the main spring forces the diaphragm to the **down** position, which closes the inlet valve and expels the fuel in the valve housing chamber through the outlet valve, to the fuel filter and the carburetor.

FUEL FILTERS

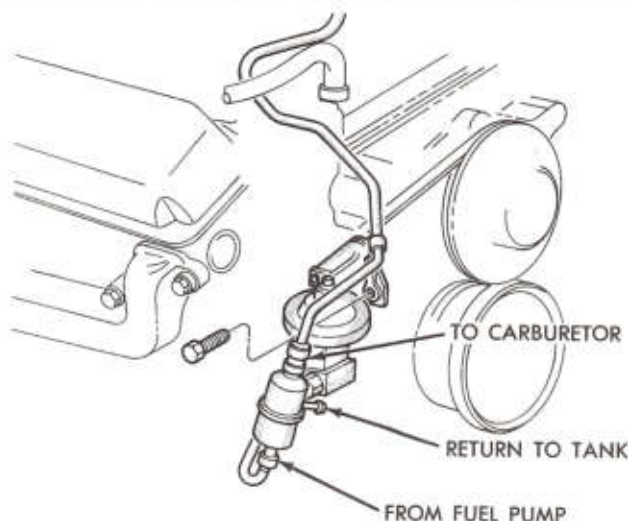
There are two fuel filters in the present fuel system. One is part of the gauge unit assembly located inside the fuel tank on the end of the fuel suction tube. This filter does not normally need servicing, but can be replaced if necessary.

The second filter (Figs. 1) is a paper element sealed, disposable type unit, located in the fuel line in the engine compartment.

FUEL FILTER VAPOR SEPARATOR

A dual-purpose fuel filter—vapor separator is used on 8 cylinder engines.

The function of the filter-separator is to filter fuel before it reaches the carburetor and to allow fuel



RY345

Fig. 1—Fuel Filter Vapor Separator 5.9L Engine

vapors to return to the fuel tank through an orifice in the return tube.

This unit is installed in the fuel line between the fuel pump and the carburetor.

FUEL HOSES AND CLAMPS

Inspect all hose connections such as clamps and couplings to make sure they are secure and no leaks are present. Hoses should be replaced immediately if there is any evidence of degradation that could result

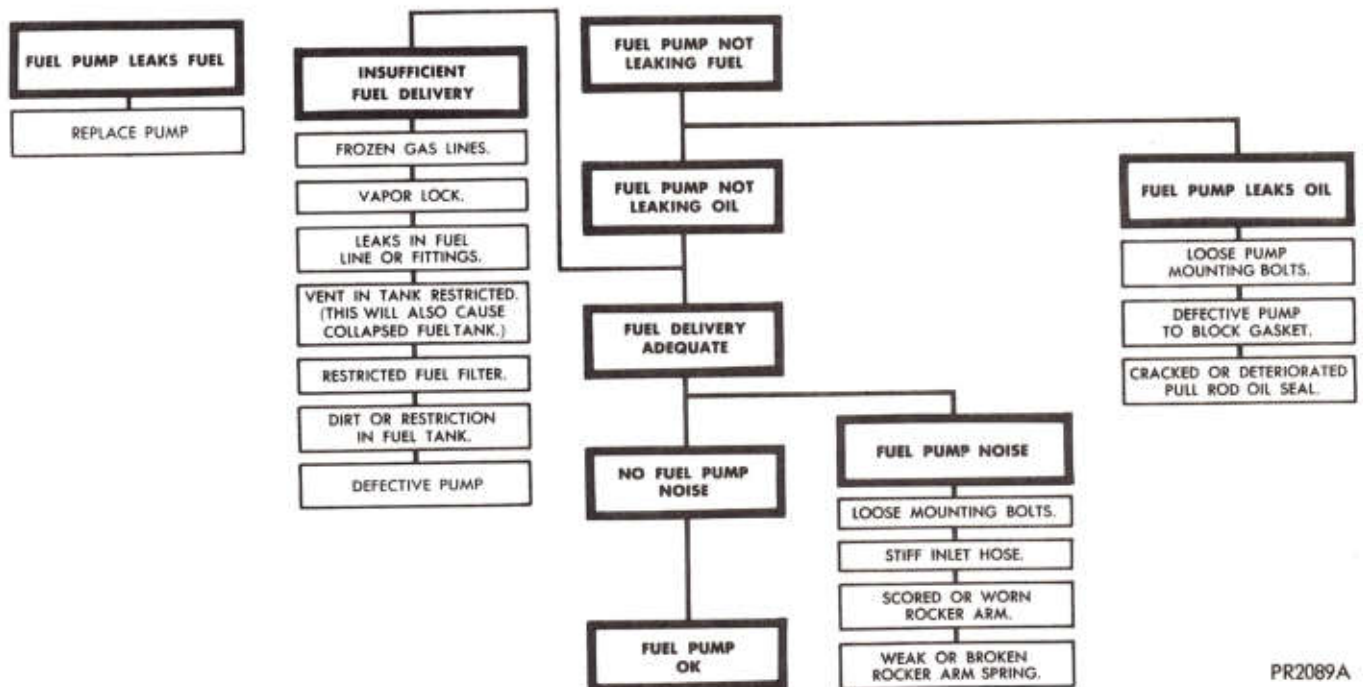
in failure. Original equipment hoses or equivalent must be used when replacement is necessary.

Avoid contact with clamps or other components that cause abrasions or scuffing. Insure that the rubber hoses are properly routed to prevent pinching and to avoid heat sources.

The original production "Keystone" hose clamps are destroyed when removed and are not reusable.

Position new clamps so that no sharp edges contact adjacent hose. Use Tool C-4124 to crimp clamp.

FUEL PUMP DIAGNOSIS (MECHANICAL)



PR2089A

SERVICE PROCEDURE

TESTING FUEL PUMP (On Vehicle)

If the fuel pump fails to supply fuel properly to the carburetor, the following tests should be made before removing the fuel pump from the vehicle.

Volume Test

The fuel pump should supply .95 liter (1 quart of fuel) in 1 minute or less at idle.

Vacuum Test

(1) Disconnect the inlet and outlet fuel lines from the fuel pump.

WARNING: Fuel lines may leak fuel when disconnected.

(2) Connect a vacuum gauge (0-25" Hg. of vacuum minimum range) to the fuel pump inlet fitting. Using the starter motor, turn the engine over several times and observe the vacuum gauge. The pump should develop a minimum of 11" Hg. of vacuum, although the readings of as high as 22" may be seen. If the pump does not develop 11" Hg. of vacuum it is defective and must be replaced.

(3) Remove the vacuum gauge.

Pressure Test

(1) Connect a pressure gauge (0-15 PSI minimum range) to the fuel pump outlet fitting. Using the starter motor, turn the engine over several times while observing the pressure gauge. The pump should develop the pressure specified for the application. If the pump does not develop sufficient pressure, it is defective and must be replaced.

(2) Remove the pressure gauge and reconnect the inlet and outlet fuel lines to the pump.

(3) Start the engine and check the pump and lines for leaks.

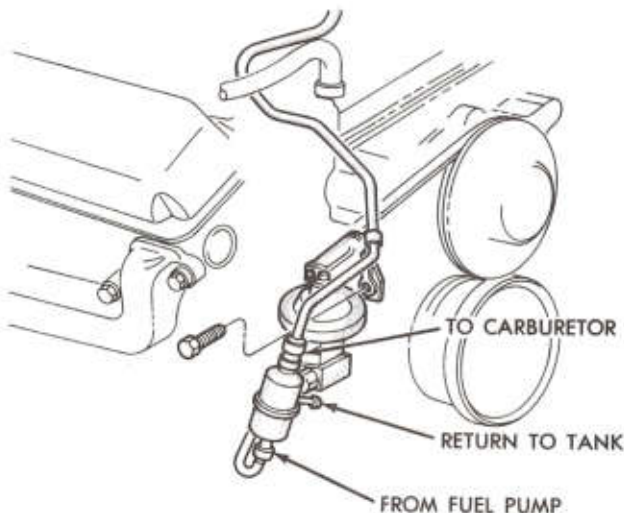
FUEL PUMP SPECIFICATIONS	
ENGINE INCH/LITER	FUEL PUMP PRESSURE
360/5.9	5.75 - 7.25 PSI

FUEL PUMP (Fig. 2)**Removal**

(1) Disconnect fuel lines from fuel pump. **FUEL SPILLAGE MAY OCCUR WHEN LINES ARE DISCONNECTED.**

(2) Remove fuel pump attaching bolts (2). Remove fuel pump.

(3) Remove and discard old gasket. Clean gasket surface on engine block.



RY345

Fig. 2—Servicing Fuel Pump**Installation**

(1) Place new fuel pump gasket on engine block.

(2) Position pump into place, install attaching bolts (2). Torque to 250 in. lbs.

(3) Connect fuel lines to fuel pump. Torque fittings to 175 in lbs.

(4) Start engine and check fuel pump fittings for leaks.

Fuel Filter and Fuel Filter Vapor Separator**Removal**

Remove hose clamps on fuel filter.

Wrap a shop towel around filter to absorb any fuel loss.

Remove filter and discard.

Inspect all hose connections such as clamps and couplings to make sure they are secure and no leaks are present. Hoses should be replaced immediately if there is any evidence of degradation that could result in failure.

Avoid contact with clamps or other components that cause abrasions or scuffing. Insure that the rubber hoses are properly routed to prevent pinching and to avoid heat sources.

The original production "Keystone" hose clamps are destroyed when removed and are not reusable.

Position new clamps so that no sharp edges contact adjacent hoses. Spring type clamps are not recommended.

Installation

Place new hoses and clamps on filter ends and crimp clamps on filter only.

Position filter in correct direction of flow on fuel tubes.

Connect fuel vapor hose with new clamp onto filter.

Crimp all clamps with Tool C-4124.

Start engine and check for leaks.

ELECTRIC FUEL PUMP SYSTEM

INDEX

	Page		Page
Fuel Filter	8	Fuel Pump	5
Removal	8	Fuel Pump Pressure Test	5
Installation	8	Fuel Pump Module Removal (Refer to Fuel	
Fuel Hoses and Clamps	8	Tank Section)	9
Fuel Pump Module Service	6	Fuel System Pressure Release Procedure	5
Assembly	7		
Disassembly	6		

FUEL PUMP (Fig. 1)

The fuel pump used in this system is an immersible pump with a permanent magnet electric motor. The fuel is drawn in through a filter sock and pushed through the electric motor to the outlet. The pump contains a check valve, located near the pump outlet, restricting fuel movement in either direction to maintain fuel supply line pressure when the pump is not operational. Voltage to operate the pump is supplied through the Auto Shutdown Relay.

The TBI fuel system is under a constant pressure of approximately 100 kPa (14.5 psi). Before servicing the fuel tank, fuel pump, fuel lines, fuel filter, or fuel components of the throttle body the fuel pressure must be released. Perform fuel system pressure release procedure.

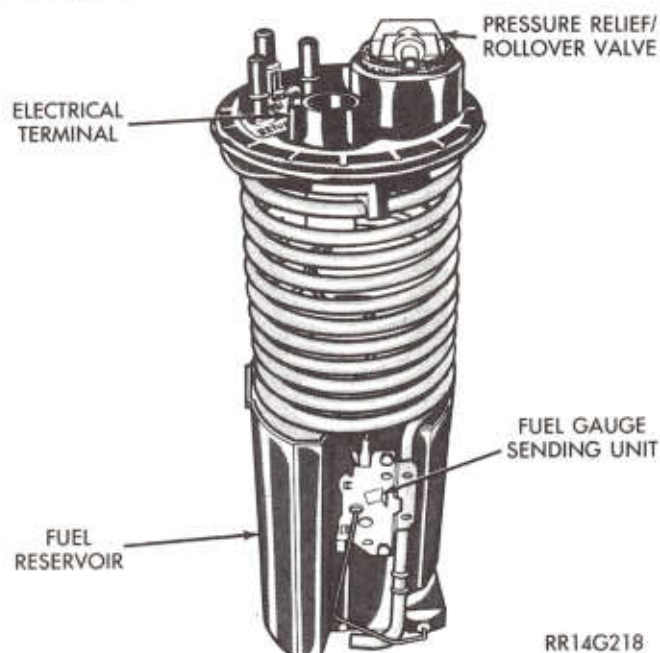


Fig. 1—Fuel Pump Module

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

- (1) Loosen gas cap to release any in tank pressure.
- (2) Remove wiring harness connector from injector harness.
- (3) Ground one injector terminal with a jumper.
- (4) Connect a jumper wire to second terminal and touch battery positive post for no longer than 10 seconds.
- (5) Remove jumper wires.
- (6) Continue fuel system service.

FUEL PUMP PRESSURE TEST

(1) Fuel system pressure must be released each time a fuel hose is to be disconnected. Perform fuel system pressure release.

(2) Disconnect 5/16 fuel supply hose from the engine fuel line assembly. Use care when removing the fuel hose to prevent damage to the hose or the fuel line. Replace hose if damaged. Connect fuel system pressure testers C-3292 and C-4749 between fuel supply hose and engine fuel line assembly.

(3) Using diagnostic tester, with the key in the "Run" position, depress the ATM button, this will activate the fuel pump and pressurize the system. If the gauge reads $100 \text{ Kpa} \pm 7 \text{ Kpa}$ ($14.5 \text{ psi} \pm 1 \text{ psi}$), pressure is correct and further testing is not required. Reinstall fuel hose using a new original equipment type clamp, and torque to 1 N·m (10 in. lbs.). If pressure is not correct, record the pressure and continue with test procedure.

(4) If fuel pressure is below specifications, install tester in the fuel supply line, between the fuel tank and fuel filter at the rear of vehicle.

(5) Repeat test. If pressure is 5 psi higher than previously recorded pressure, replace fuel filter. If no

change is observed, gently squeeze return hose. If pressure increases, replace pressure regulator. If no change is observed, problem is either a plugged pump filter sock or defective fuel pump.

(6) If pressure is above specifications, remove the fuel return line hose from the chassis line at fuel tank and connect a 3 foot piece of fuel hose to the return line. Put the other end into an approved gasoline container (minimum 2 gallon size) so that all return fuel will flow into container. Repeat test. If pressure is now correct, check in-tank return hose for kinking. Replace fuel pump assembly if in-tank reservoir check valve or aspirator jet is obstructed. (This test should be performed when fuel tank is 1/2 full or greater.)

(7) If pressure is still above specifications, remove fuel return hose from throttle body. Connect a substitute hose to the throttle body return nipple and place other end of hose in clean container. Repeat test. If pressure is now correct, check for restricted fuel return line. If no change is observed, replace fuel pressure regulator.

Mechanical Malfunctions

Mechanical malfunctions are more difficult to diagnose with this system. The Single Module Engine Controller (SMEC) has been programmed to compensate for some mechanical malfunctions such as incorrect cam timing, vacuum leaks etc. If engine performance problems are encountered, and no fault codes are displayed, the problem may be mechanical rather than electronic.

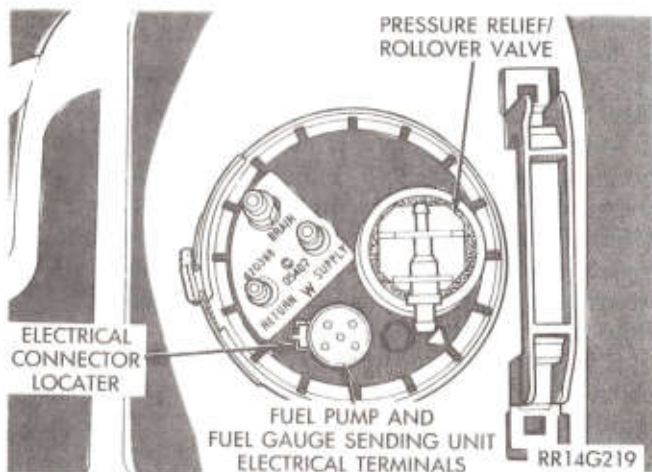


Fig. 2—Top View of Fuel Pump Module

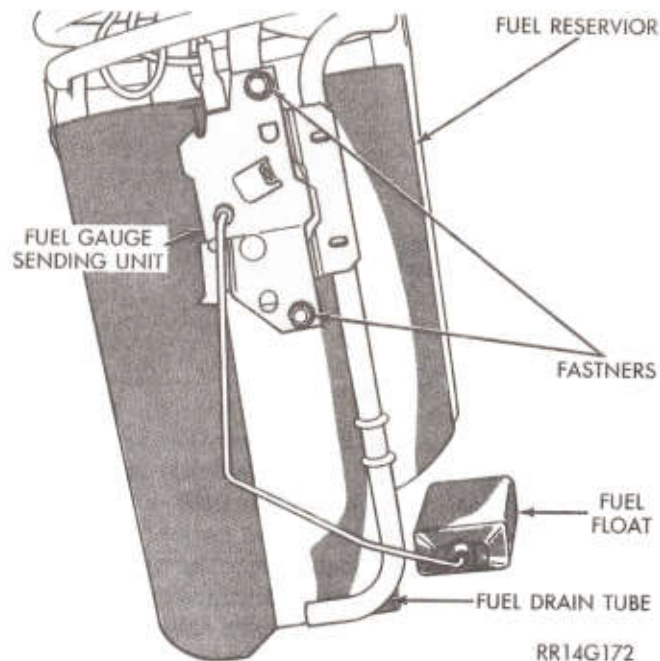


Fig. 3—Fuel Gauge Sending Unit Service
FUEL PUMP MODULE SERVICE

Disassembly

(1) Remove sending unit attaching screws (2) from mounting bracket located on the drain tube. (Fig. 3).

(2) Carefully, disconnect electrical wires from sending unit (Fig. 4). Remove sending unit.

(3) Remove the drain tube from the mounting lug at the bottom of the reservoir (Fig. 5).

(4) Remove the lower-most coil of the drain tube out of the mounting lugs on top of the reservoir (Fig. 5). Care should be taken to avoid unsnapping the return line check valve cover from the bottom of the reser-

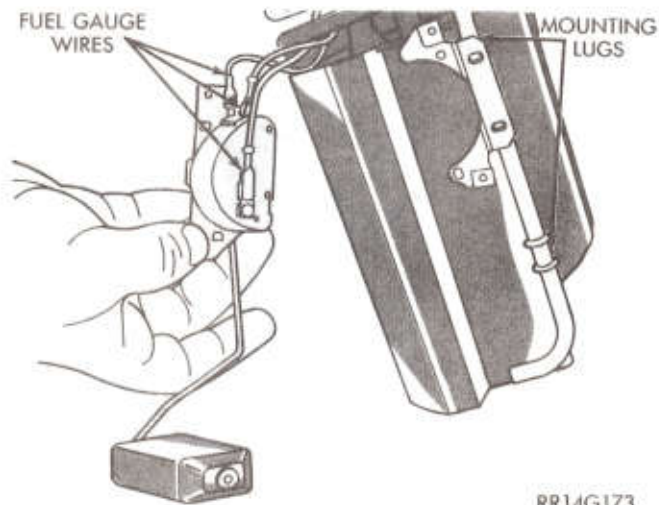


Fig. 4—Fuel Gauge Sending Unit Wiring Terminals

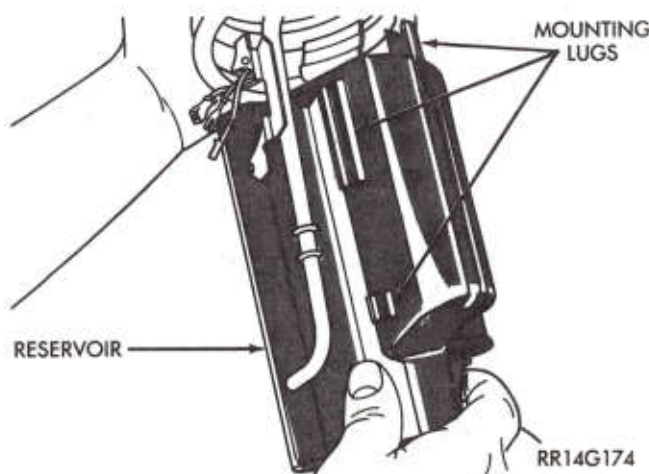


Fig. 5—Removing Fuel Line Coil from Reservoir

voir. If this cap comes free, snap back into place (Fig. 6).

(5) Release the pump mounting bracket from the reservoir using thumb and fore fingers. Press the bracket with both thumbs toward the center of the reservoir (Figs. 7 and 8).

(6) Remove pump mounting bracket and rubber collar from hose and retain. Cut hose clamp on the supply line to the pump. Discard clamp. Remove pump/filter assembly from hose (Fig. 9)

(7) If pump is operational but the filter requires replacement, gently "walk" a broad bladed screwdriver around the filter mounting ferrule to remove filter (Fig. 10). Care should be taken to avoid damage to the pump inlet. If pump is not operational, discard entire assembly. Do not reuse filter.

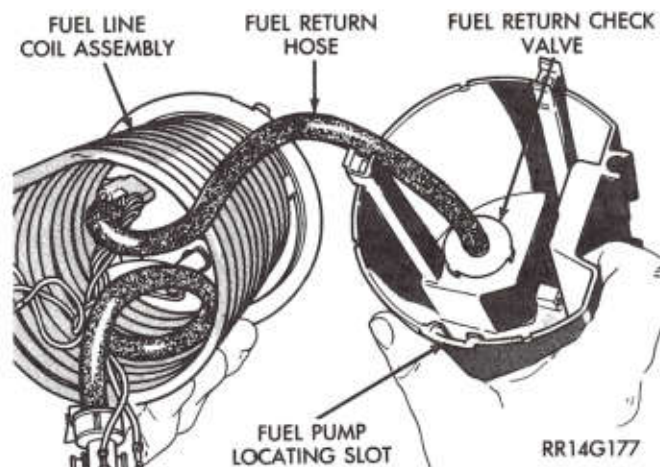


Fig. 6—Fuel Pump and Reservoir Assembly

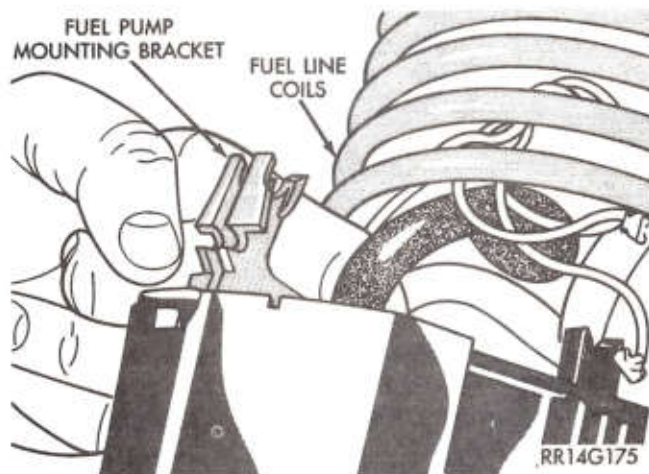


Fig. 7—Fuel Pump Mount Bracket

Assembly

(1) Press new filter onto pump. (New pumps are provided with new filters.)

(2) Use a new clamp to attach the pump to the supply hose. Use Tool C-4124 to crimp clamp.

(3) Reposition pump mounting bracket and rubber collar on supply hose between the bulge in the hose and the pump. (Fig. 9).

(4) Position the pump in the reservoir such that the filter aligns with the cavity in the reservoir (Fig. 8).

(5) Snap pump bracket/collar into the reservoir (Fig. 7).

(6) Position coil tube onto reservoir so that the drain tube aligns with mounting lugs on reservoir. (Fig. 5).

(7) Snap lower-most coil into mounting lugs on top of the reservoir.

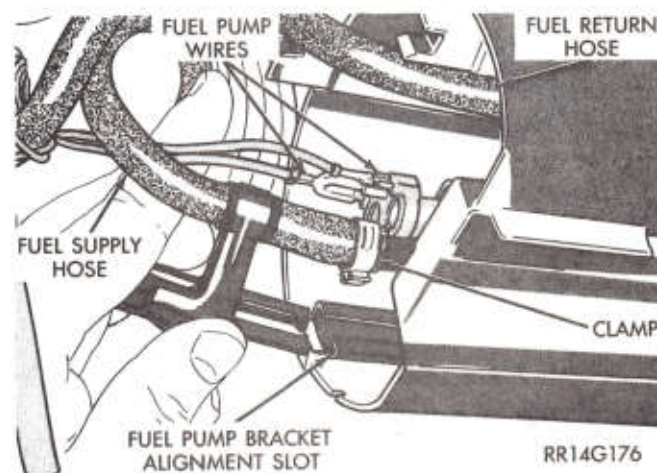


Fig. 8—Removal and Installation of Fuel Pump

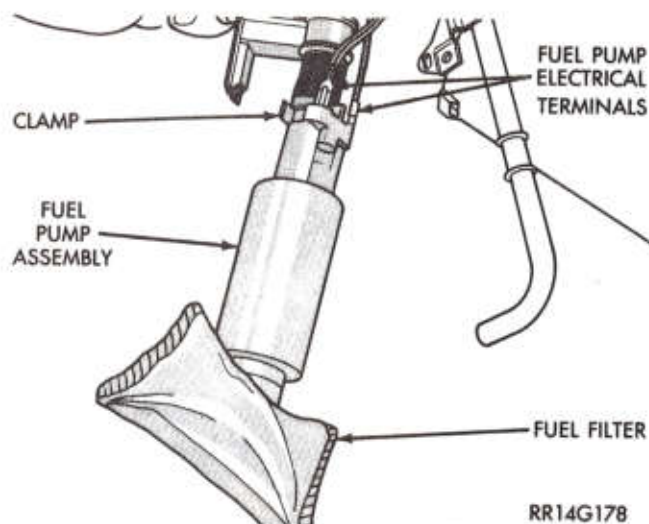


Fig. 9—Servicing Fuel Pump

(8) Snap the drain tube into the lugs on the bottom of the reservoir.

(9) Connect electrical wires to new sending unit. (Fig. 4).

(10) Align index tab on new level unit with index hole on mounting bracket.

(11) Attach new level unit to mounting bracket with screws. (Fig. 3).

(12) Install reassembled unit into fuel tank, as per fuel pump installation procedures in the Fuel Tank Section.

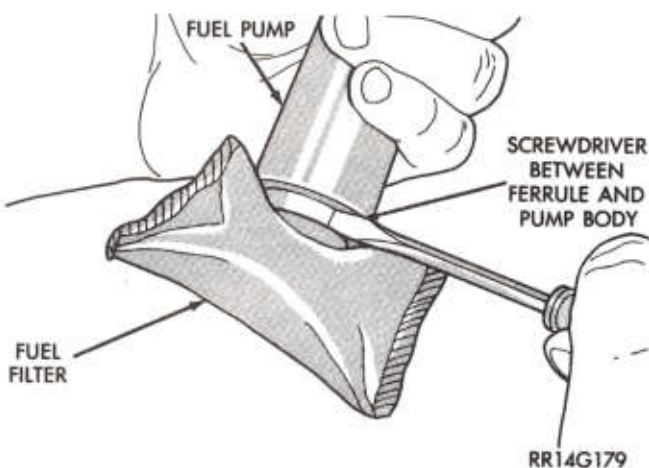


Fig. 10—Servicing Fuel Filter

FUEL FILTER

Removal (Fig. 11).

- (1) Perform fuel system pressure release.
- (2) Remove filter retaining screw and remove filter assembly from mounting plate.
- (3) Loosen outlet hose clamp on filter and inlet hose clamp on rear fuel tube.

- (4) Wrap a shop towel around hoses to absorb fuel. Remove hoses at filter and fuel tube. Discard clamps.

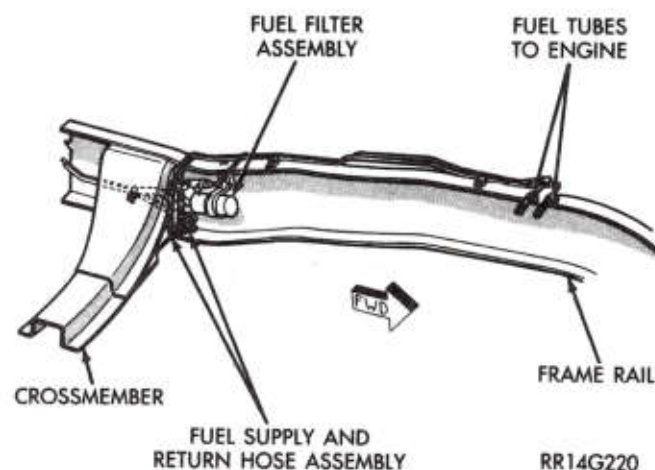


Fig. 11—Fuel Filter 3.9L and 5.2L Engines

Installation

- (1) Install inlet hose on fuel tube and tighten new clamp to 1 N·m (10 in. lbs.).
- (2) Install outlet hose on filter outlet fitting and tighten new clamp to 1 N·m (10 in. lbs.).
- (3) Position filter assembly on mounting plate and tighten mounting screw to 8 N·m (75 in. lbs.).

FUEL HOSES AND CLAMPS

Inspect all hose connections such as clamps and couplings to make sure they are secure and no leaks are present. Hoses should be replaced immediately if there is any evidence of degradation that could result in failure.

Avoid contact with clamps or other components that cause abrasions or scuffing. Insure that the rubber hoses are properly routed to prevent pinching and to avoid heat sources.

The hoses used on fuel injected vehicles are of special construction due to the possibility of contaminated fuel in this system. If it is necessary to replace these hoses, only hoses marked EFM/EFI may be used.

The hose clamps used on fuel injected vehicles are of a special rolled edge construction to prevent the edge of the clamp cutting into the hose. Only these rolled edge type clamps may be used in this system, all other types of clamps may cut into the hoses and cause high pressure fuel leaks.

Use new original equipment type hose clamps, torque hose clamps to 1 N·m (10 in. lbs.).

FUEL TANKS

INDEX

	Page		Page
Fuel Pump Module	12	Fuel Tank Pressure Relief and Rollover Valve	
Removal	12	TBI Engines	18
Installation	16	Removal	18
Fuel Reservoir	12	Installation	18
Fuel Tanks	10	Fuel Gauge Sending Unit Service (TBI Engine) ...	17
Draining Fuel Tanks	10	Fuel Gauge Sending Unit 5.9L Engine	
Removal	10	Removal	17
Installation	11	Installation	17
Fuel Tank Capacities	10	General Information	9
Fuel Tank Skid Plate	10	Heat Shields	10
Fuel Tank Rollover and Liquid Vapor		No-Lead Fuel Tank Filler Tube	9
Separator Valve	18	Pressure-Vacuum Filler Cap	9

GENERAL INFORMATION

Chrysler Motors built vehicles pass a full 360° rollover without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections.

All models have the rollover valve mounted in the top of the fuel tank. On vehicles equipped with a return line from the fuel pump to the fuel tank, a one-way check valve is used to provide the required protection. In addition to the valve, improved flow control is used in the fuel pump to control flow when the pump is subjected to the higher than normal pressure which can occur during rollover. A fuel filler cap with a higher pressure setting is used for the same reason on vehicles with side fill.

An evaporation control system is used to reduce the emissions of fuel vapors into the atmosphere by evaporation and reduce the unburned hydrocarbons emitted by the vehicle engine. When fuel evaporates from the fuel tank, or carburetor float bowl the vapors pass through vent hoses or tubes to a charcoal canister where they are temporarily held until they can be drawn in the intake manifold when the engine is running.

Inspect all hose connections such as clamps and couplings to make sure they are secure and no leaks are present. Hoses should be replaced immediately if there is any evidence of degradation that could result in failure.

Avoid contact with clamps or other components that cause abrasions or scuffing. Insure that the rubber hoses are properly routed to prevent pinching and to avoid heat sources.

The hoses used on fuel injected vehicles are of a special construction due to the higher fuel pressures involved in this system. If it is necessary to replace these hoses, only hoses marked EFM/EFI may be used.

The hose clamps used on fuel injected vehicles are of a special rolled edge construction to prevent the edge of the clamp cutting into the hose. Only these rolled edge type clamps may be used on this system, all other types of clamps may cut into the hoses and cause high pressure fuel leaks.

NO-LEAD FUEL TANK FILLER TUBE

All catalyst equipped vehicles have a special fuel tank filler tube. The fuel filler opening is smaller in diameter than those used for noncatalyst vehicles to permit entry of only the smaller no-lead fuel nozzles. In addition a deflector, which is opened by the no-lead fuel nozzle, deters the addition of fuel by means other than the proper nozzle.

The fuel filler tube on these models is equipped with a one way ball check valve designed to prevent fuel spit back which may occur while filling the tank.

A label is attached to the instrument panel under the fuel gauge that reads "UNLEADED FUEL ONLY" as a reminder to the driver. A similar label is located near the fuel tank filler.

PRESSURE-VACUUM FILLER CAP

The loss of any fuel or vapor out of the filler neck is prevented by the use of a pressure-vacuum filler cap. Relief valves within the cap will release only under significant pressure (1.9 to 2.5 psi) or vacuum (.15 to .30 psi). This cap must be replaced by a similar unit if replacement is necessary, in order for the system to remain effective.

CAUTION: Remove filler cap prior to removing or repairing any fuel or vent lines.

FUEL TANK CAPACITIES

	Liters	U.S. Gallons
Standard	83.0	22
Optional	132.4	35
Ramcharger	120.9	34

Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.

FUEL TANK SKID PLATE

A protective metal skid is available for the Ramcharger 34 gallon fuel tank (Fig. 1). The skid plate is mounted by bolts in the left and right frame rails and mounting brackets in the front and rear which are bolted to crossmembers.

HEAT SHIELDS

The sheet metal heat shields must be removed when servicing the fuel lines or vapor vent line. It is very important that these heat shields be reinstalled after service to protect the lines from the heat of the exhaust system. See Group 11 in this manual for proper installation.

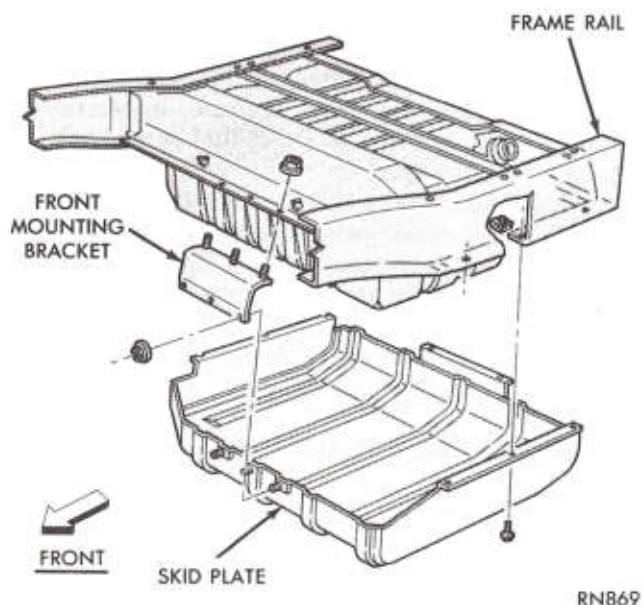


Fig. 1—Fuel Tank Skid Plate

FUEL TANKS

Draining Fuel Tank 5.9L Engine

- (1) Remove fuel filler cap.
- (2) Disconnect battery ground cable.
- (3) Raise vehicle on hoist.

- (4) Disconnect the fuel supply hose from supply tube at the frame connection.

WARNING: Wrap shop towels around hoses to catch any gasoline spillage.

- (5) Connect a siphon hose to the fuel supply tube on the frame.

- (6) Drain fuel tank dry into holding tank or a properly labeled "gasoline" safety container.

Draining Fuel Tank 3.9L and 5.2L Engine (Figs. 2 and 3)

- (1) Remove fuel filler cap and perform fuel system pressure release.
- (2) Disconnect battery ground cable.
- (3) Raise vehicle on hoist.
- (4) Remove drain tube rubber cap located on cross-member in front of the fuel tank and connect either a portable holding tank or a siphon hose to drain tube.
- (5) Drain fuel tank dry into holding tank or a properly labeled "gasoline" safety container.

Fuel System Pressure Release

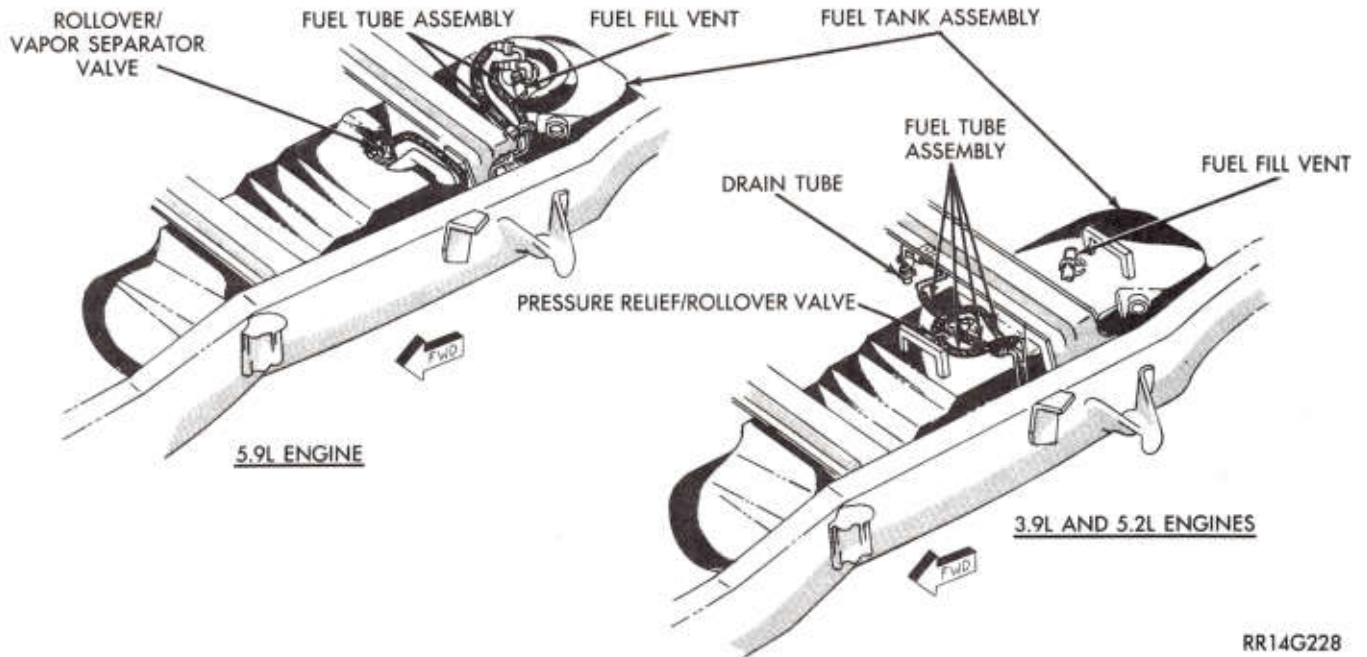
The TBI fuel system is under a constant pressure of approximately 100 kPa (15 psi). Before servicing the fuel tank the fuel pressure must be released as follows:

- (1) Loosen fuel filler cap to release any fuel tank pressure.
- (2) Remove wiring harness connector from any injector harness.
- (3) Ground one injector terminal with jumper wire.
- (4) Connect one end of a jumper wire to one injector terminal and touch the other end to the battery positive post for no longer than ten seconds.
- (5) Remove jumper wires.
- (6) Continue fuel system service.

FUEL TANK (MID-FRAME MOUNTED) (Figs. 5, 6 and 8)

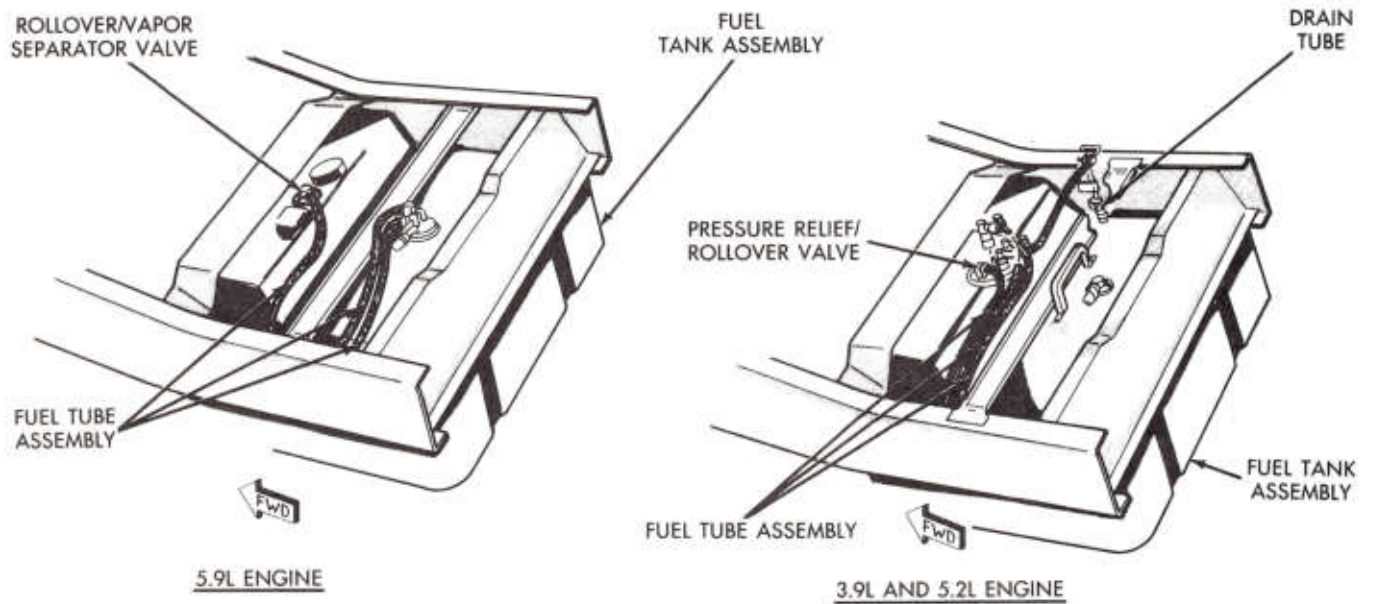
Removal

- (1) Disconnect battery ground cable.
- (2) Remove fuel tank filler cap before disconnecting any fuel or vent lines. The tank could be under a small pressure.
- (3) Pump all fuel from fuel tank into an approved portable holding tank. If this equipment is not available, disconnect fuel line and drain tank dry into a properly identified "Gasoline" safety container.
- (4) Raise vehicle on hoist and disconnect all vent hoses and filler hose.
- (5) Place a transmission jack, centrally, under the fuel tank and apply slight pressure.
- (6) Remove the nuts from the outboard ends of the two straps and lower tank far enough to allow the gauge wire and fuel lines to be disconnected from the



RR14G228

**Fig. 2—Fuel Hose Connections to Fuel Tank
Mid-Frame Mounted Models**



RR14G229

**Fig. 3—Fuel Hose Connections to Fuel Tank
Ramcharger Models**

gauge unit on top of the tank. For fuel injected vehicles squeeze locking tabs on connector to release (Fig. 4).

Then lower tank further and remove from under vehicle.

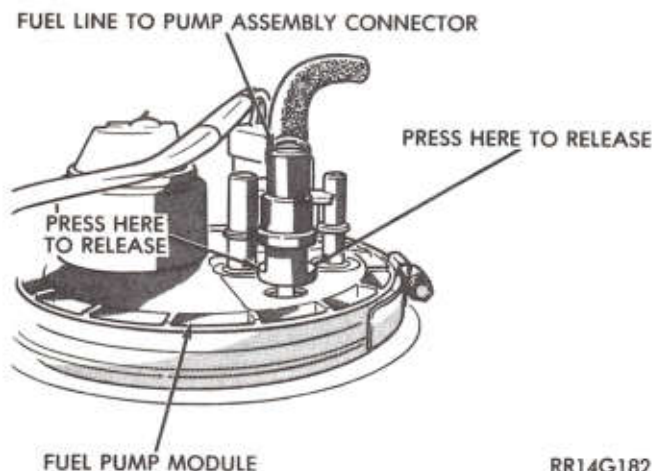


Fig. 4—Fuel Hose Fitting on Fuel Pump Module

Installation

(1) Place fuel tank on top of transmission jack and raise high enough to connect the fuel line and gauge wire to the gauge unit on top of the tank.

(2) Raise tank into position in crossmembers and connect the two end retaining straps. Remove transmission jack. Tighten all straps firmly. **Do not over tighten retaining strap nuts.**

(3) Connect vent hoses.

(4) Connect fuel line if it was disconnected to drain tank. Recap drain tube.

(5) Refill fuel tank and inspect all hoses and lines for leaks. Connect battery cable.

FUEL TANKS (RAMCHARGER MODELS) (Fig. 7)

Removal

(1) Disconnect battery ground cable.

(2) Remove fuel tank filler cap before disconnecting any lines. The tank could be under a small pressure.

(3) Pump all fuel from tank into an approved portable holding tank. If this equipment is not available, disconnect fuel line and connect a siphon hose. Drain fuel tank dry into a properly identified "Gasoline" safety container.

(4) Raise vehicle on hoist.

(5) Place transmission jack under center of tank and apply slight pressure. Disconnect the two "J" bolts and remove retaining straps at the rear of the tank and lower tank from under vehicle.

(6) Disconnect fuel lines for (fuel injected vehicles squeeze locking tabs on connector to release (Fig. 4) and vent line and wire lead to gauge unit—remove ground strap.

(7) Remove fuel filler tube hose and fill vent hose from tank.

(8) Remove fuel tank.

Installation

(1) Position tank on transmission jack under vehicle and hoisting tank into position.

(2) Connect "J" bolts and retaining straps. Tighten the nuts on the "J" bolts as shown in Fig. 7 View "A". Remove jack.

(3) Connect filler tube and all vent hoses install new hose clamps and tighten securely.

(4) Connect fuel supply and return hoses and ECS hoses, ground strap and wire lead to gauge unit.

(5) Connect fuel line if disconnected to drain tank. Recap drain tube.

(6) Refill fuel tank and inspect all hoses and lines for leaks.

(7) Reconnect battery ground cable.

FUEL RESERVOIR (Fig. 9)

The fuel pump is mounted within a fuel reservoir in the fuel tank. The purpose of the reservoir is to provide fuel at the pump intake during all driving conditions, especially those when low fuel levels are present. The fuel return line directs fuel into the reservoir.

FUEL PUMP MODULE (Fig. 9)

Removal

It is necessary to remove fuel tank from vehicle to replace fuel pump. Follow fuel tank removal procedure.

(1) Hold the fuel pump module down while loosening the holding clamp. (It is under a slight spring pressure (Fig. 10).

(2) Once clamp is loosened. Release the module and it will spring up from its position.

(3) Remove module from tank.

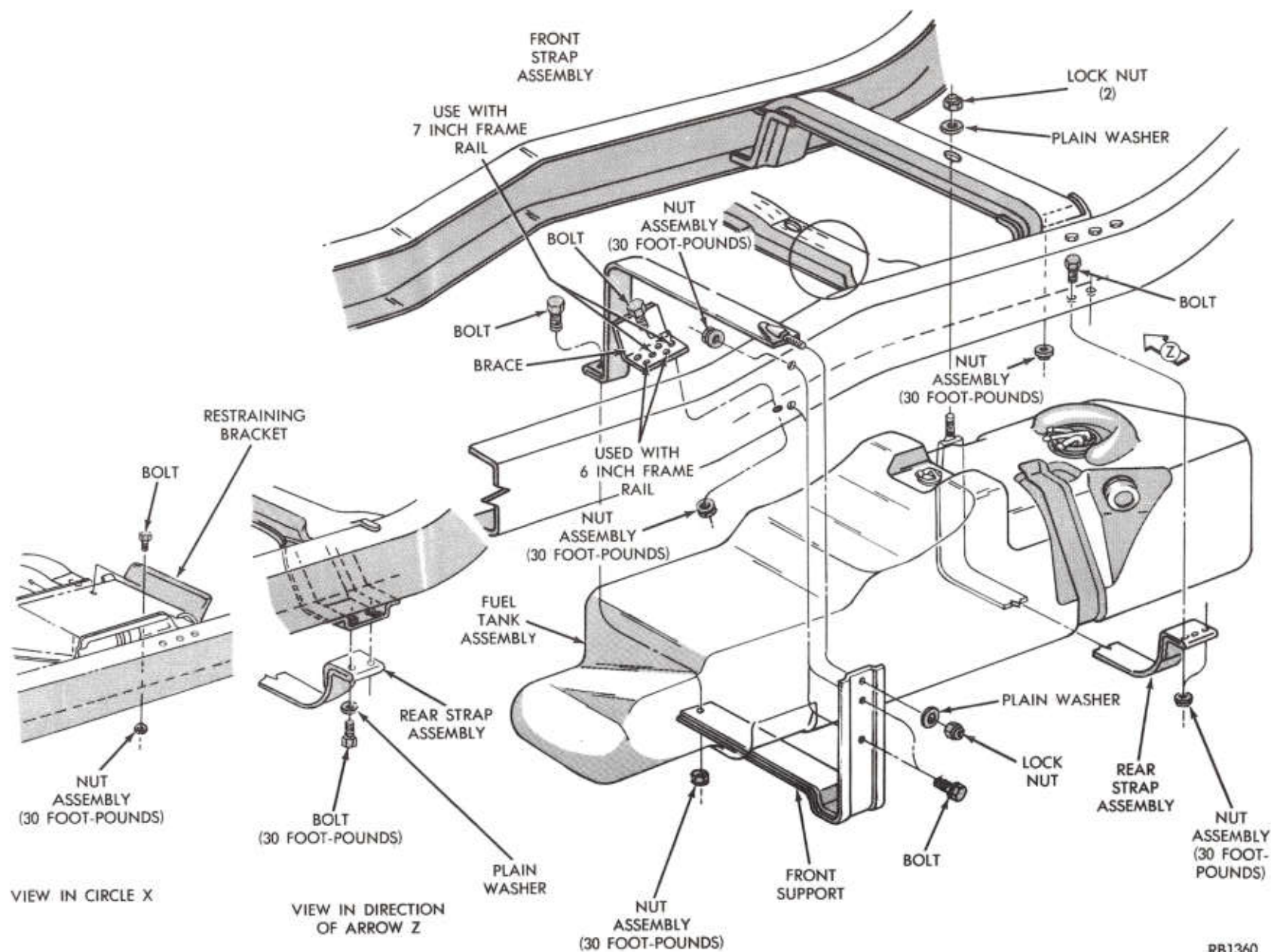
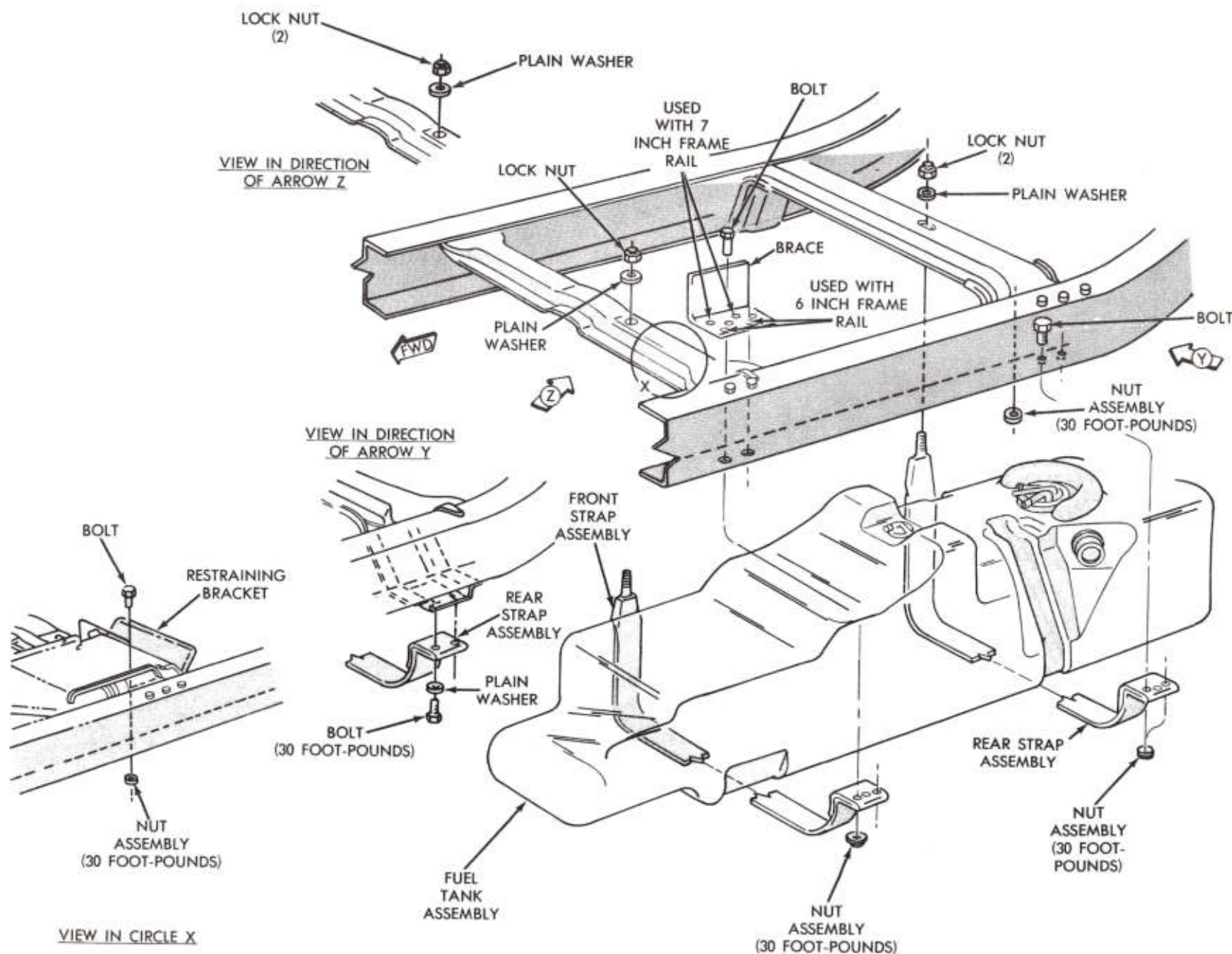


Fig. 5—Fuel Tank 22 and 30 Gallon Mid Frame Mounted (All 100-350 Models Except 115" and 149" Wheelbase)



RB1361

Fig. 6—Fuel Tank 22 and 30 Gallon Mid Frame Mounted (All 115" and 149" Wheelbase

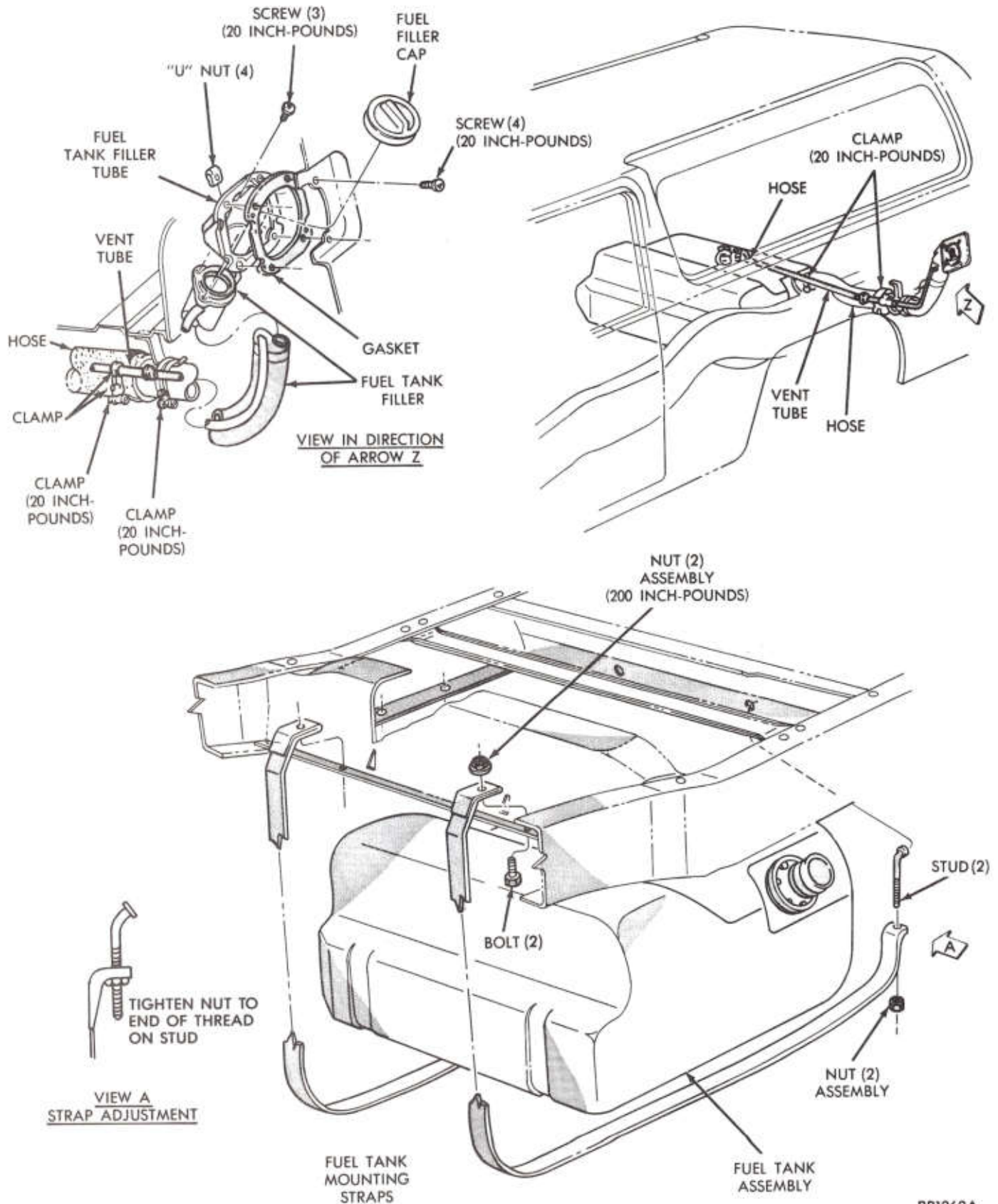


Fig. 7—Fuel Tank Filler Tube, Ramcharger Models

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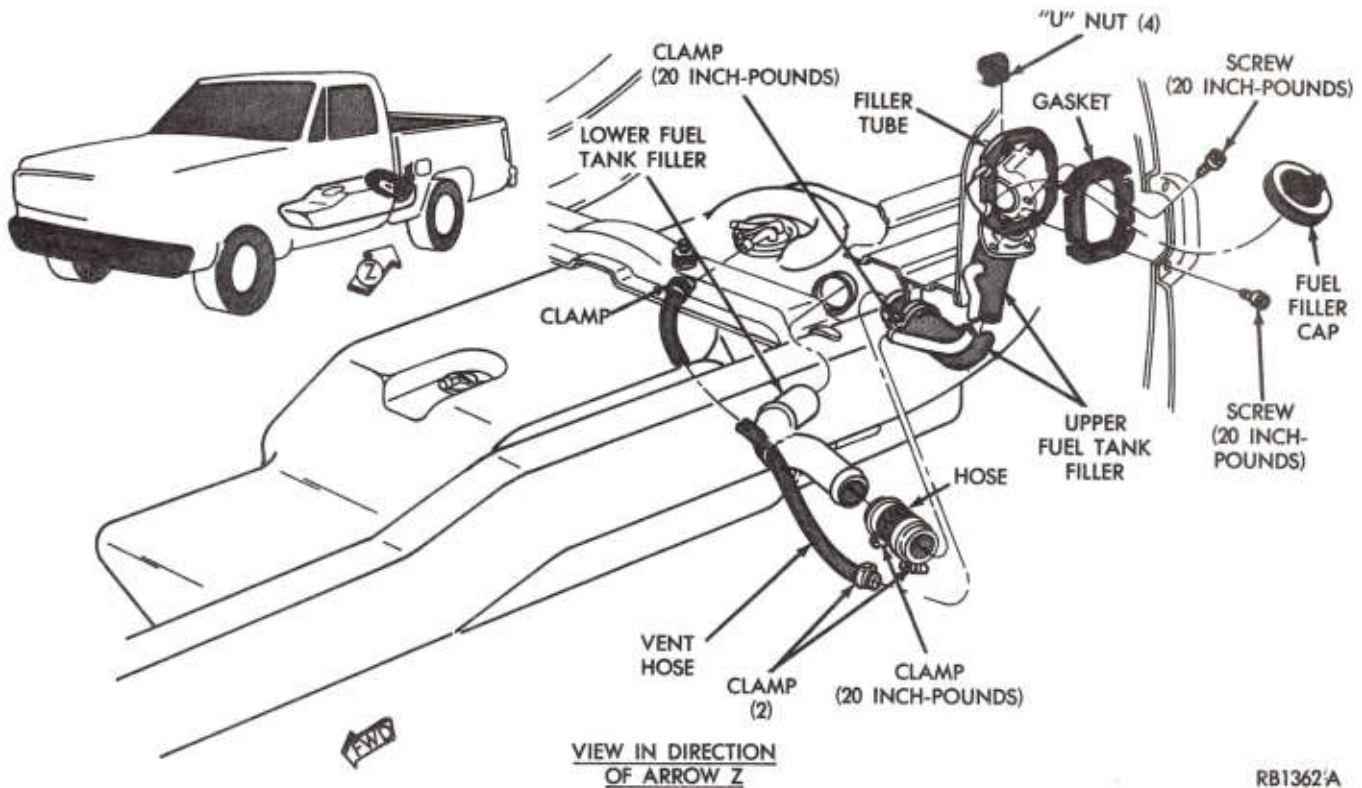


Fig. 8—Fuel Tank Tubes Mid Frame Mounted 22 and 30 Gallon Fuel Tanks

Installation

- (1) Wipe seal area of tank clean and place a new O-ring seal in position on pump.
- (2) Align fuel pump module with retaining bracket

on bottom of tank (Fig. 11).

- (3) With module in place. Push the module down and install clamp and tighten clamp to 4.5 N·m (40 in. lbs.)

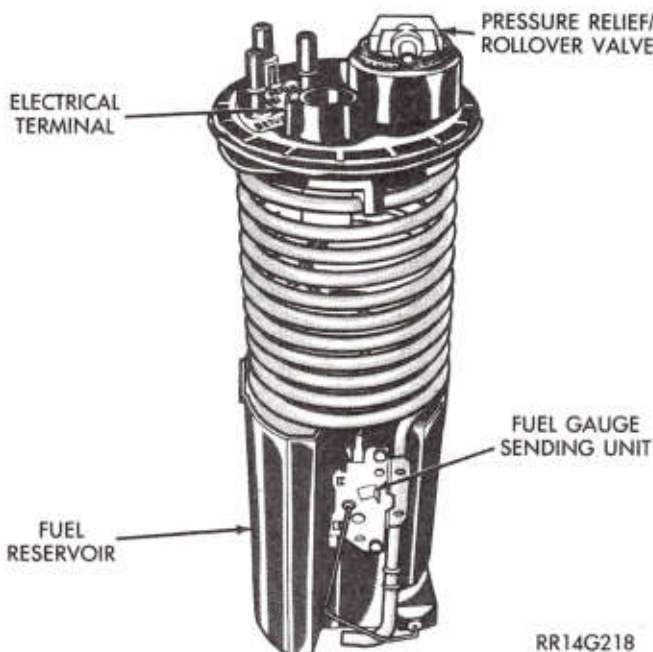


Fig. 9—Fuel Pump Module

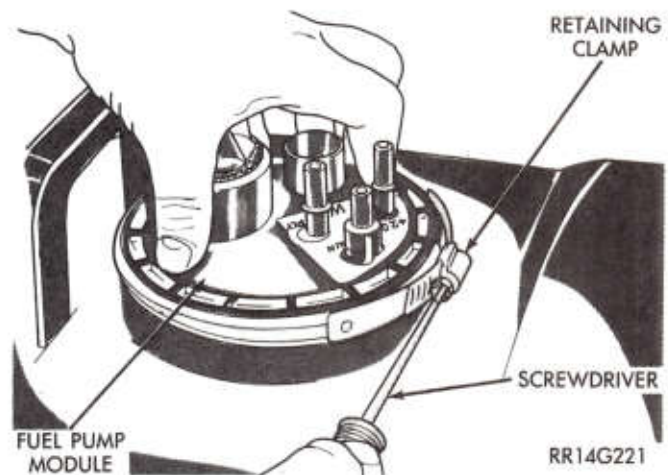


Fig. 10—Servicing Fuel Pump

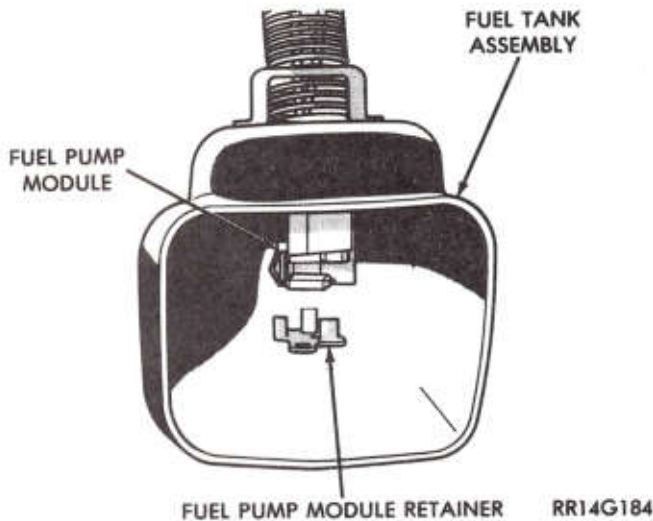


Fig. 11—Fuel Pump Installation and Removal

FUEL GAUGE SENDING UNIT SERVICE (TBI ENGINES)

The fuel gauge sending unit is attached to the fuel pump module (Fig. 12). The fuel pump module must be removed to perform this operation. Refer to fuel pump module removal of this section.

Removal

- (1) Remove level unit retaining screws (2) from mounting bracket on drain tube (Fig. 12).
- (2) Disconnect electrical wires from level unit (Fig. 13).
- (3) Reverse above procedure for installation.

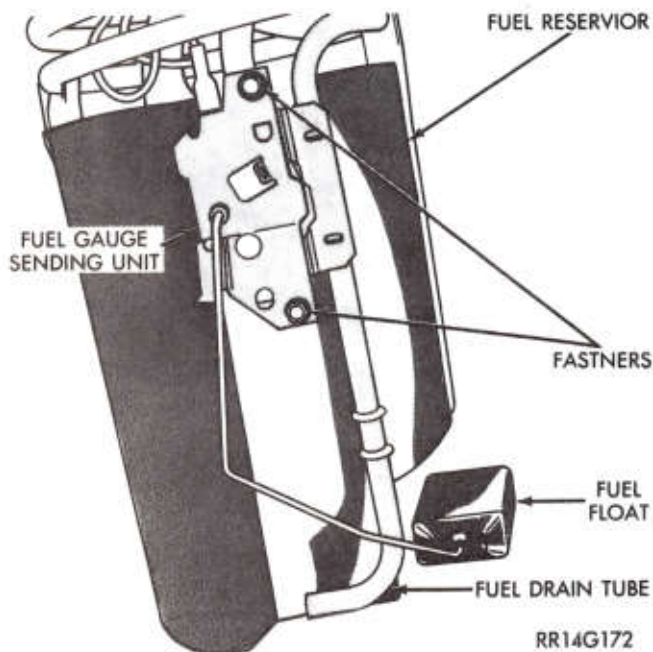


Fig. 12—Fuel Gauge Sending Unit

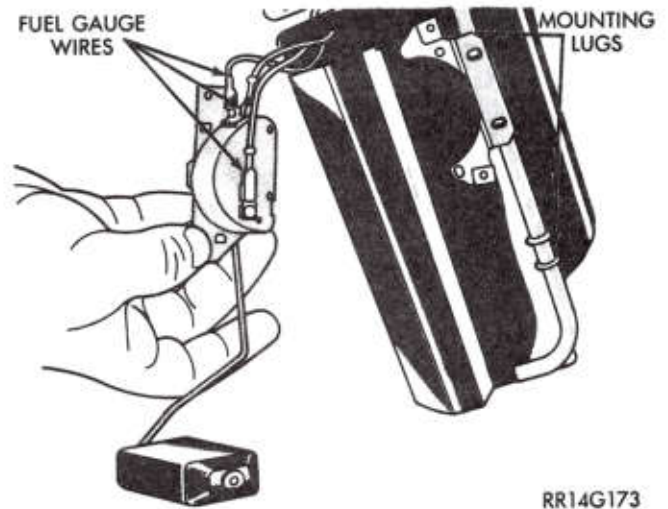


Fig. 13—Servicing Fuel Gauge Sending Unit

Fuel Gauge Sending Unit 5.9L Engine

Fuel tank sending unit flanges are being potted or filled with grease or wax to prevent mud packing of this area. The need for this potting is to prevent corrosion to the wiring connections and sending unit fuel supply tubes.

If the sending unit must be removed for any reason, the grease or wax must be removed to prevent this material from falling into the fuel tank. If servicing requires additional cleaning of the material, the grease or wax may be removed with mineral spirits or kerosene.

Removal

With fuel tank removed from vehicle clean the grease or wax from the sending unit cavity. Remove sending unit by unscrewing the unit lock ring from the tank. Use caution to prevent foreign material from entering the tank. Remove the old sending unit gasket.

Installation

Install new sending unit gasket. Place sending unit in tank opening and tighten lock ring. Apply MoPar multipurpose lubricant P/N 2932524 or equivalent in the cavity area. Use caution to ensure the fuel tubes are not plugged with grease.

FUEL TANK ROLLOVER AND LIQUID VAPOR SEPARATOR VALVE 5.9L (FIGS. 14 AND 15) AND FUEL TANK PRESSURE RELIEF AND ROLLOVER VALVE TBI ENGINES (FIG. 16).

All vehicles pass a full 360° rollover without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections. A rollover valve is mounted in the top of the fuel tank to prevent fuel leakage if vehicle is accidentally rolled over.

Removal

- (1) Remove fuel tank (refer to fuel tank removal).
- (2) Wedge the blade of a screwdriver between the rubber grommet and the fuel tank. **Do not wedge between the valve and the grommet or damage to the valve may result upon removal.**
- (3) To remove the grommet from the valve simply place the valve upright on a flat surface and push down on the grommet peeling it down off the valve.

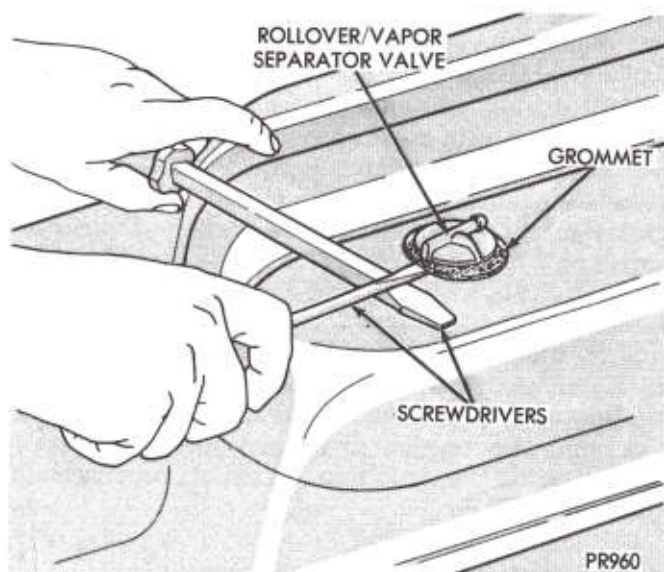


Fig. 14—Removing Rollover/Vapor Separator Valve

Installation

- (1) Install the rubber grommet in the fuel tank and work it around the curled lip.
- (2) Lubricate the grommet with **Power Steering Fluid** and push the valve downward into the grommet. Twist valve until properly positioned.
- (3) Install fuel tank (refer to fuel tank installation).

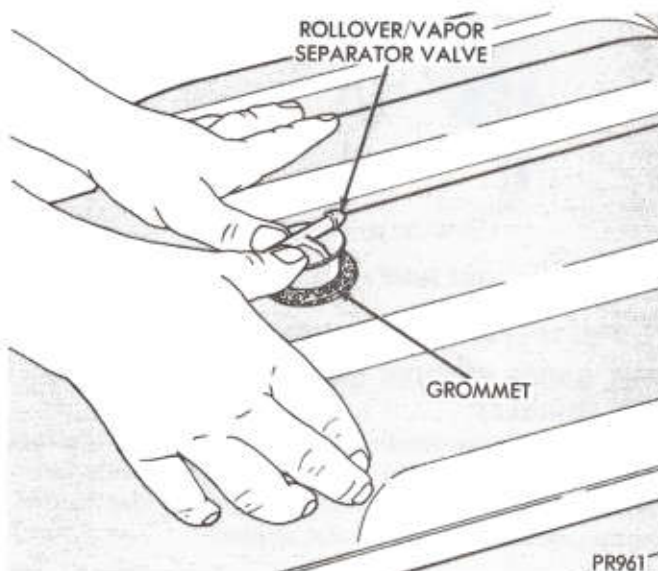


Fig. 15—Installing Rollover/Vapor Separator Valve

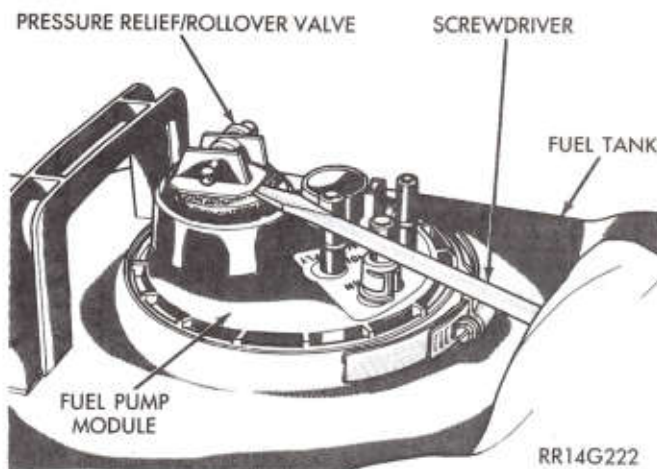


Fig. 16—Servicing Pressure Relief/Rollover Valve TBI Engines

ACCELERATOR PEDAL AND THROTTLE CONTROLS

INDEX

	Page		Page
Accelerator Pedal	19	Service Procedures	19
Removal	19	Throttle Controls	19
Installation	19	Removal	19
General Information	19	Installation	20

GENERAL INFORMATION

All models have two torsion return springs on the carburetor, and an accelerator pedal return spring (extension spring) which gives positive throttle return

and lower throttle pedal efforts while meeting safety requirements.

SERVICE PROCEDURES

ACCELERATOR PEDAL (Fig. 1)

Removal

From inside the vehicle, hold up the pedal and remove the cable retainer and throttle cable from the upper end of the pedal shaft.

Working from the engine compartment, remove nuts from pedal shaft and bracket assembly studs. Remove assembly from vehicle.

Installation

Position assembly on dash panel and install retaining nuts, tighten to specifications. From inside the vehicle, hold up the pedal and install the throttle cable and cable retainer in the upper end of the pedal shaft.

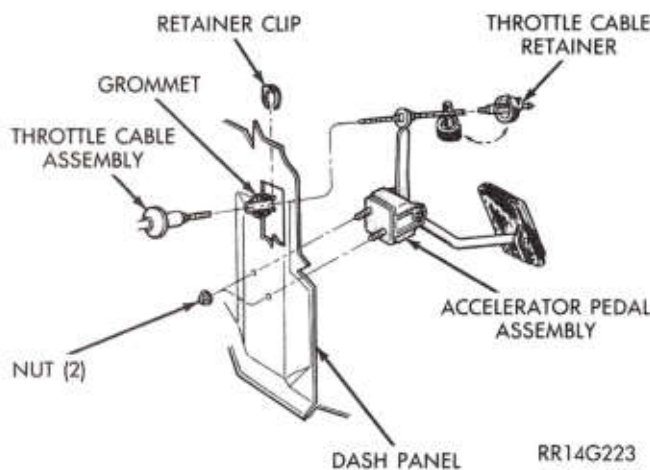


Fig. 1—Accelerator Pedal Removal or Installation

THROTTLE CONTROLS (Figs. 2 and 3)

Removal

From inside the vehicle, remove the cable housing retainer clip and core wire cable retainer. Next, remove the core wire from the pedal shaft. From the engine compartment, pull the housing end-fitting out of the dash panel grommet. The grommet should remain in the dash panel hole. Remove the cable slug from the throttle body cam or carburetor lever stud. Now, the cable mounting bracket will separate by using wide jaw pliers to compress the end-fitting tabs.

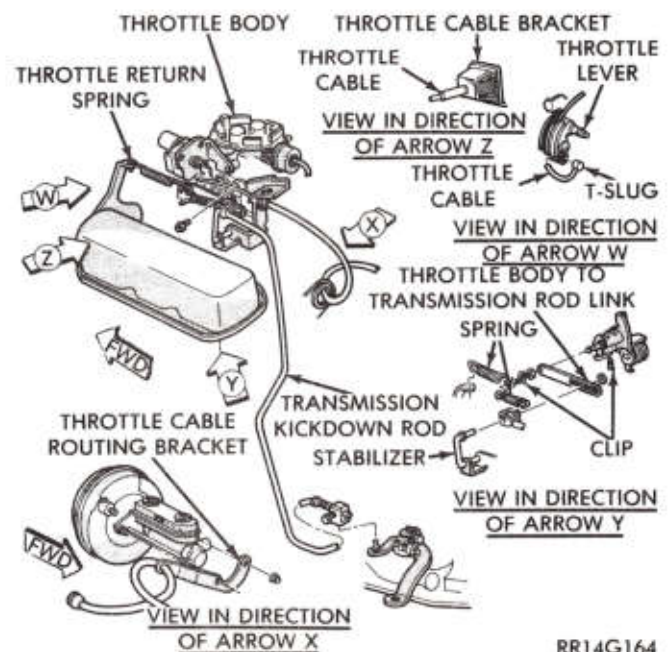
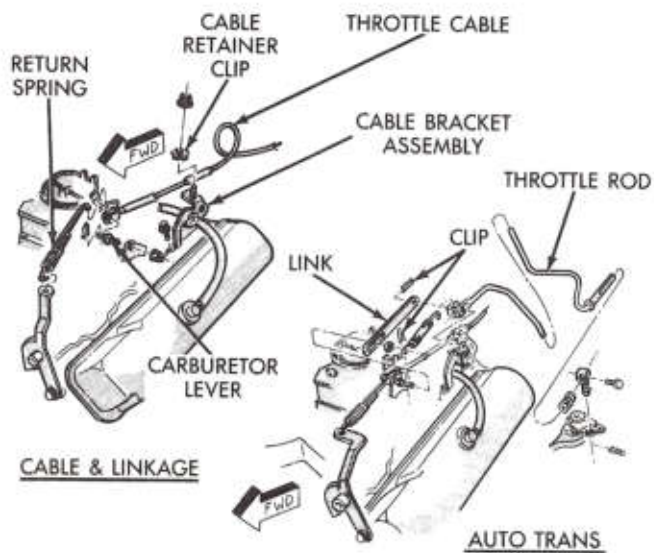


Fig. 2—Throttle Cable Attachment 3.9L and 5.2L Engines



RR14G230

Fig. 3—Throttle Control Attachment 5.9L Engine

Installation

Install the cable housing (throttle body or carburetor end) into the cable mounting bracket on the engine and attach the cable slug with the retaining clip onto the throttle body cam or carburetor lever stud. Install the remaining cable housing end-fitting into the dash panel grommet and attach the housing retainer clip from inside the vehicle. Install the ball end of the cable through the hole in the pedal shaft and install the plastic cable retainer.

ELECTRONIC FUEL INJECTION 3.9L AND 5.2L ENGINES

CONTENTS

SENSOR SPECIFICATION	Page	THROTTLE BODY FUEL INJECTION	Page
SPECIAL TOOLS	82		21

THROTTLE BODY FUEL INJECTION

INDEX

COMPONENT IDENTIFICATION	Page	GENERAL INFORMATION	Page
GENERAL DIAGNOSIS	21	SERVICE PROCEDURES	21
	25		36

COMPONENT IDENTIFICATION

INDEX

	Page		Page
Air Conditioning Cut Out Relay	24	Heated Oxygen Sensor (O ₂ Sensor)	23
Auto Shutdown (ASD) Relay	24	Check Engine Lamp	24
Canister Purge Solenoid	24	Single Module Engine Controller (SMEC)	22
Coolant Temperature Sensor	23	Switch Input	23
Fuel Injectors	24	Throttle Body	24
Fuel Pressure Regulator	27	Throttle Position Sensor (TPS)	27
Idle Speed Control (ISC) Actuator	27	Throttle Body Temperature Sensor	
Manifold Absolute Pressure (Map) Sensor	23	(5.2L Engine)	27

GENERAL INFORMATION

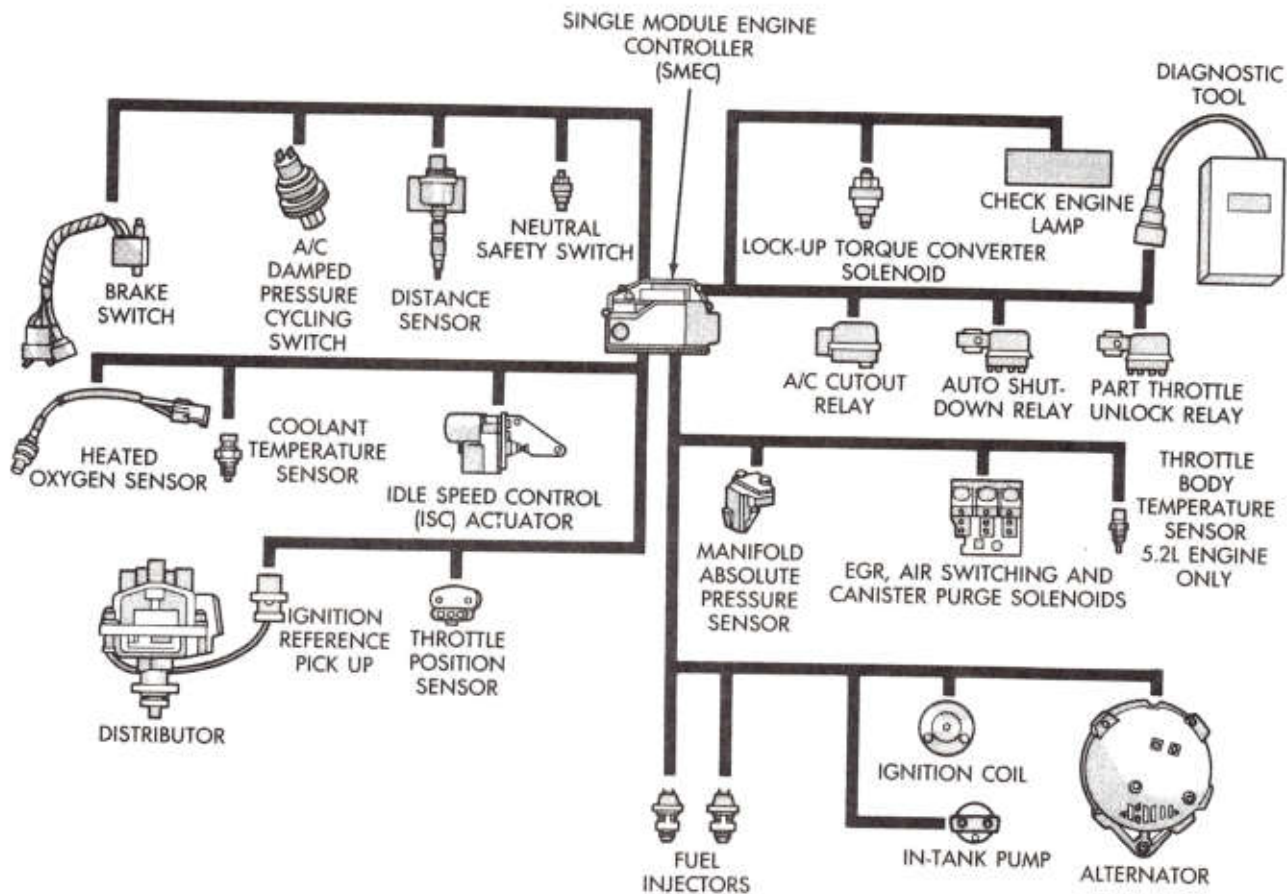
The Throttle Body Fuel Injection System (Fig. 1) is a computer regulated single point fuel injection system that provides precise air/fuel ratio for all driving conditions. At the center of this system is a digital pre-programmed computer known as Single Module Engine Controller (SMEC) that regulates ignition timing, air-fuel ratio, emission control devices, charging system, and idle speed. This component has the ability to update and revise its programming to meet changing operating conditions.

Various sensors provide the input necessary for the Single Module Engine Controller (SMEC) to correctly regulate the fuel flow at the fuel injector. These include the Manifold Absolute Pressure, Throttle Position, Oxygen Sensor, Coolant Temperature, and Vehicle Distance sensors. In addition to the sensors,

various switches and relays also provide important information. These include the Neutral-safety Switch, Air Conditioning Clutch Relay, and Auto Shut Down Relay.

All inputs to the Single Module Engine Controller are converted into signals. These signals cause change to either the fuel flow at the injector or ignition timing or both.

The Single Module Engine Controller (SMEC) tests many of its own input and output circuits. If a fault is found in a major system, this information is stored in the Memory. Information on this fault can be displayed to a technician by means of the instrument panel check engine lamp or by connecting a diagnostic read out and reading a numbered display code which directly relates to a general fault.



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Fig. 1—Throttle Body Fuel Injection Components

SINGLE MODULE ENGINE CONTROLLER (SMEC) (Fig. 2)

The SMEC contains the circuits necessary to drive the ignition coil, fuel injector, and the alternator field. These are high current devices and have been isolated to minimize any electrical noise in the passenger compartment.

The Automatic Shut Down (ASD) relay is mounted externally, but is turned on and off by the SMEC. Distributor pick-up signal goes to the SMEC. In the event of no distributor signal, the ASD relay is not activated and power is shut off from the fuel injector and ignition coil. The SMEC contains a voltage converter which converts battery voltage to a regulated 8.0 volts output. This 8.0V output powers the distributor pick-up. The internal 5 volts supply which in turn powers the MAP sensor and TPS.

The SMEC is digital computer containing a micro-processor. The module receives input signals from

various switches and sensors. It then computes the fuel injectors pulse width, spark advance, ignition coil dwell, idle speed, purge, and alternator charge rate.

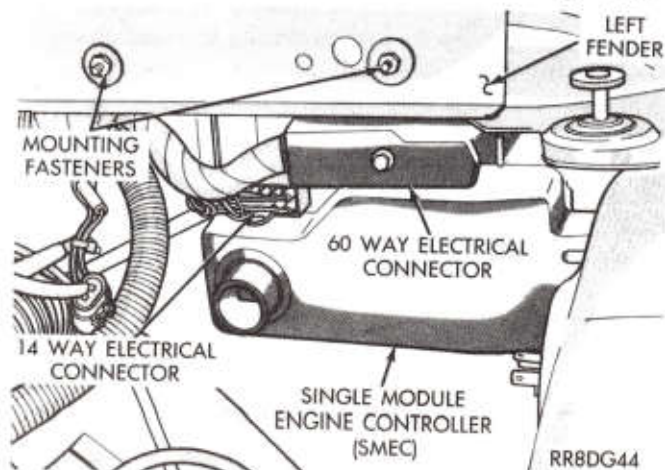


Fig. 2—Single Module Engine Controller (SMEC)

The SMEC tests many of its own input and output circuits. If a fault is found in a major system, this information is stored in the SMEC. Information on this fault can be displayed to a technician by means of the instrument panel check engine lamp or by connecting the diagnostic tool and reading a numbered display code which directly relates to a general fault.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR (Fig. 3)

The Manifold Absolute Pressure (MAP) sensor is a device which monitors manifold vacuum. It is mounted underhood on the left side of the engine tunnel and is connected to a vacuum nipple on the throttle body and electrically to the Single Module Engine Controller (SMEC). The sensor transmits information on manifold vacuum conditions and barometric pressure to the SMEC. The MAP sensor data on engine load is used with data from other sensors to determine the correct air fuel mixture.

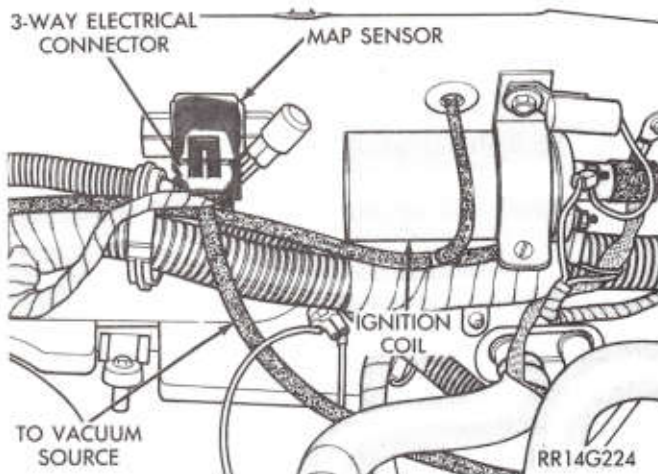


Fig. 3—Manifold Absolute Pressure (MAP) Sensor Location

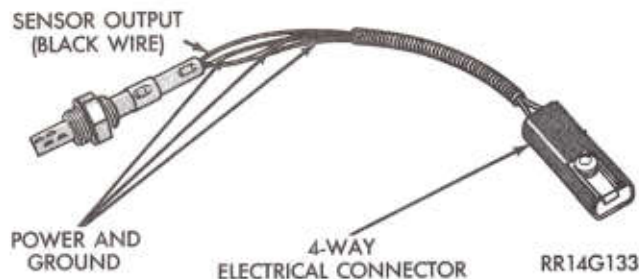


Fig. 4—Heater Oxygen Sensor

HEATED OXYGEN SENSOR (O₂ SENSOR) (Fig. 4)

The Oxygen Sensor (O₂ Sensor) is a device which produces an electrical voltage when exposed to the oxygen present in the exhaust gasses. The sensor is mounted in the exhaust system and is electrically heated internally for faster switching when the engine is running. When there is a large amount of oxygen present (lean mixture), the sensor produces a low voltage. When there is a lesser amount present (rich mixture) it produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch. The voltage is transmitted to the Single Module Engine Controller (SMEC) which changes the fuel injectors pulse width. The injector changes the mixture. Refer to Group 25 for more information.

COOLANT TEMPERATURE SENSOR (Fig. 5)

The Coolant Temperature Sensor is a device which monitors coolant temperature (which is the same as engine operating temperature). This sensor provides the data on engine operating temperature to the SMEC. This allows the SMEC to demand slightly richer air-fuel mixtures and higher idle speeds until normal operating temperatures are reached.

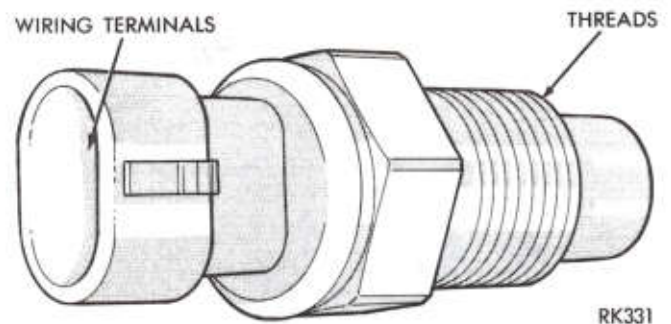


Fig. 5—Coolant Sensor

SWITCH INPUT

Various switches provide information to the SMEC. These include the Neutral Safety Switch, Air Conditioning Clutch and Brake Light switches. If one or more of these switches is sensed as being in the on position, the SMEC singles the Idle Speed Control (ISC) Actuator to maintain idle speed to a scheduled rpm.

CHECK ENGINE LAMP

This lamp comes on each time the ignition key is turned on and stays on for three seconds as a bulb test.

If the SMEC receives an incorrect signal or no signal from certain sensors, or emission related systems (California vehicles only) the lamp on the instrument panel is turned on. This is a warning that the SMEC has gone into a limp-in mode in an attempt to keep the system operating. It signals an immediate need for service.

The lamp can also be used to display fault codes. Cycle the ignition switch on-off-on-off-on within five seconds and any fault codes stored in the Memory will be displayed.

CANISTER PURGE SOLENOID (Fig. 6)

The Purge Solenoid is controlled by the SMEC. When engine temperature is below 3.9L 27°C (80°F) 5.2L 61°C (145°F) the SMEC grounds the Purge Solenoid energizing it. This prevents vacuum from reaching the charcoal canister valve. When this temperature is reached the SMEC de-energizes solenoid by turning the ground off. Once this occurs vacuum will flow to the canister purge valve and purge fuel vapors through the throttle body.

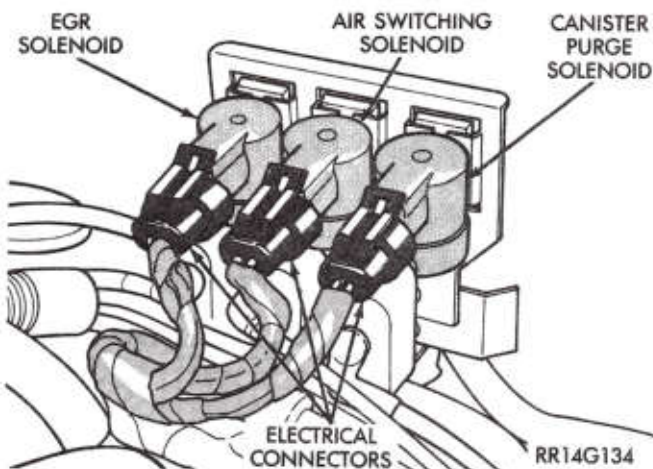


Fig. 6—Canister Purge Solenoid

AIR CONDITIONING CUT-OUT RELAY (Fig. 7)

The air conditioning cut-out relay is connected in series electrically with the A/C clutch. This relay is the energized closed (on) position during engine operation. When the SMEC senses low idle speeds and wide open throttle through the throttle position sensor, it will de-energize the relay, open its contacts and prevent air conditioning clutch engagement.

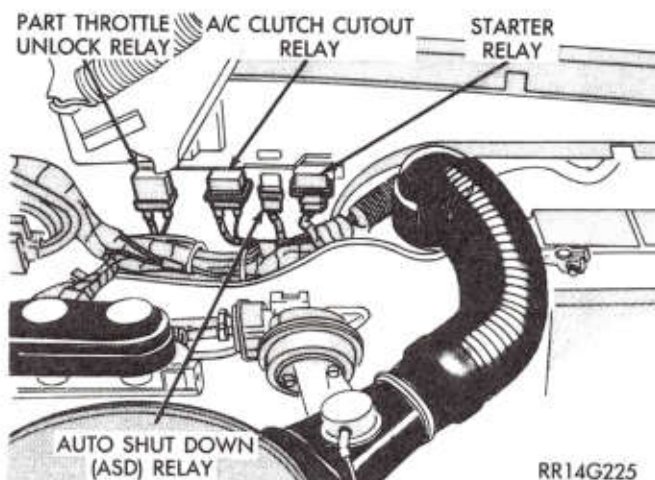


Fig. 7—Engine Compartment Relay Identification
AUTO SHUTDOWN (ASD) RELAY (Fig. 7)

When there is no ignition signal present with the ignition key in the "RUN" position, there is no need for fuel delivery. When this condition occurs, the auto shutdown relay interrupts power to the electric fuel pump, fuel injectors, and ignition coil.

THROTTLE BODY (Figs. 8 and 9)

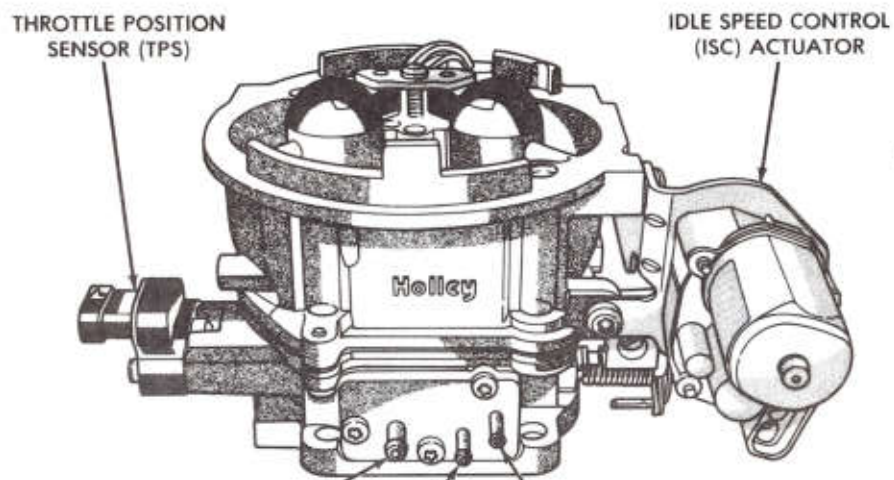
The Throttle Body Assembly replaces a conventional carburetor and is mounted on top of the intake manifold. The throttle body houses the Fuel Injector, Pressure Regulator, Throttle Position Sensor, Throttle Body Temperature Sensor (5.2L only), Idle Speed Control (ISC) Actuator. Air flow through the throttle body is controlled by a cable operated throttle blade located in the base of the throttle body. The throttle body itself provides the chamber for metering atomizing and distributing fuel through out the air entering the engine.

FUEL INJECTORS (Fig. 10)

The Fuel Injectors are an electric solenoid driven by the Single Module Engine Controller (SMEC).

The SMEC based on sensor inputs determines when and how long the fuel injectors should operate. When electrical current is supplied to the injector a spring loaded ball is lifted from its seat. This allows fuel to flow through six spray orifices and deflects off the sharp edge of the injector nozzle. This action causes the fuel to form a 45° cone shaped spray pattern before entering the air stream in the throttle body.

Fuel is supplied to the injectors constantly at regulated 14.5 psi. the unused fuel is returned to the fuel tank.

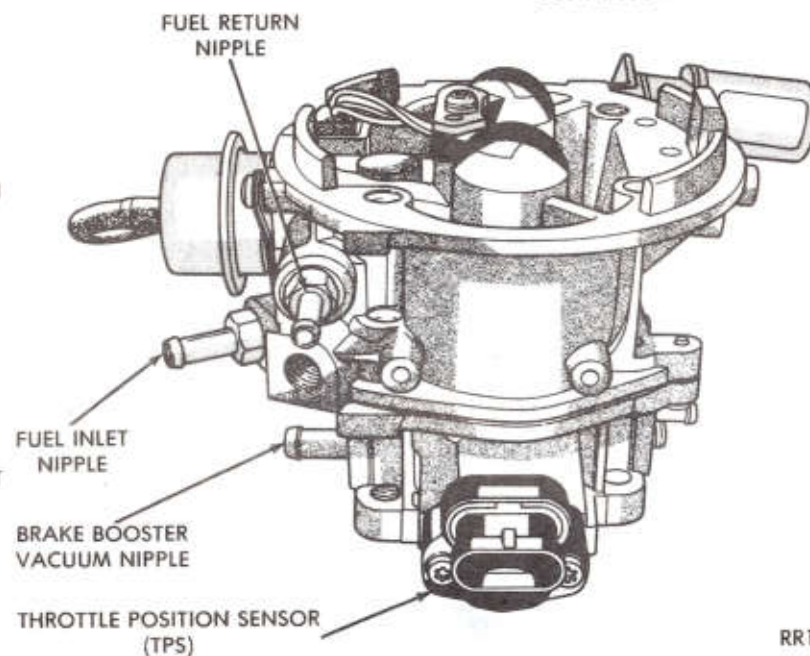
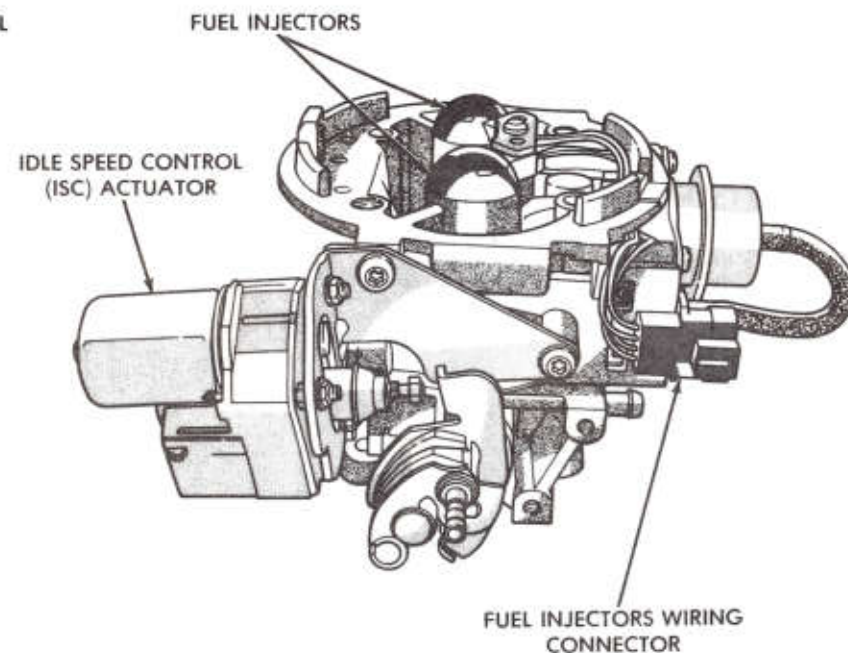
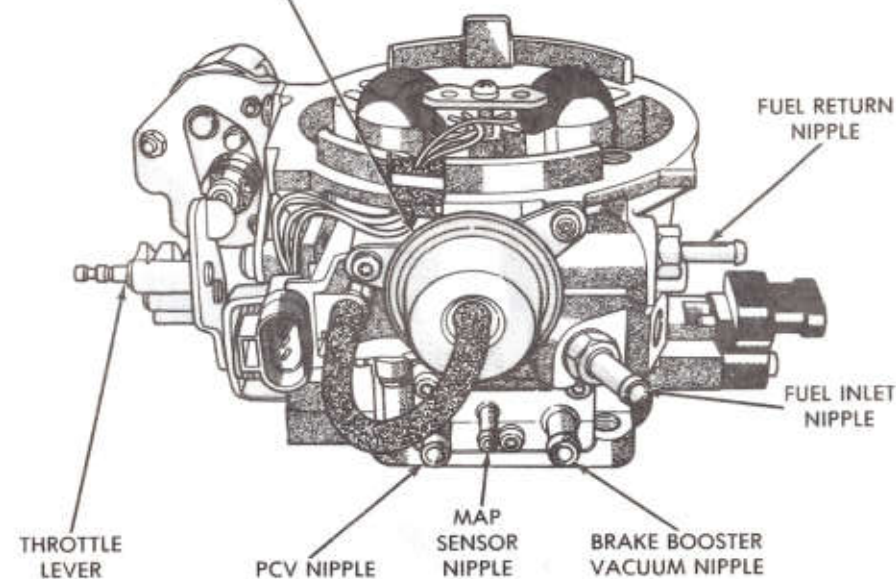


CANISTER PURGE NIPPLE

DIVERTER VALVE NIPPLE

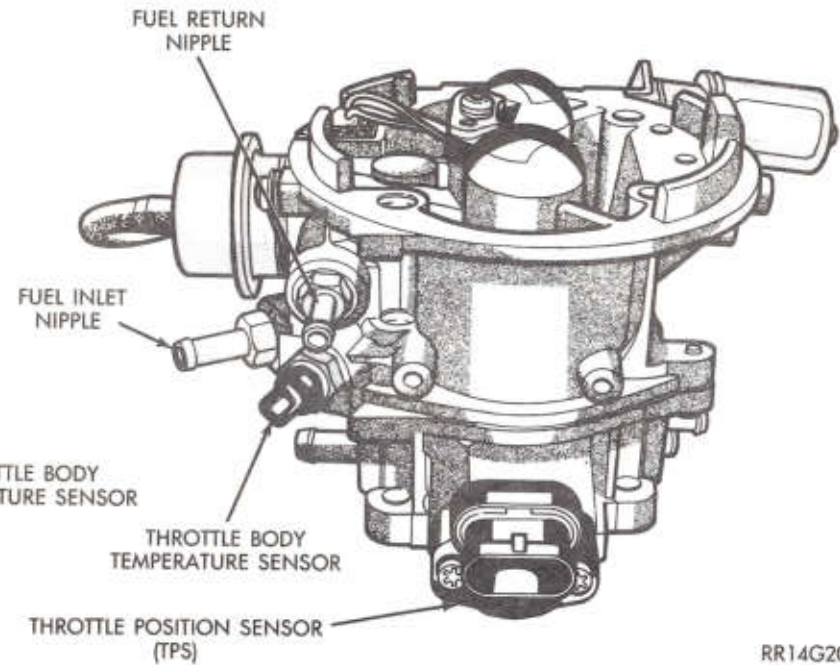
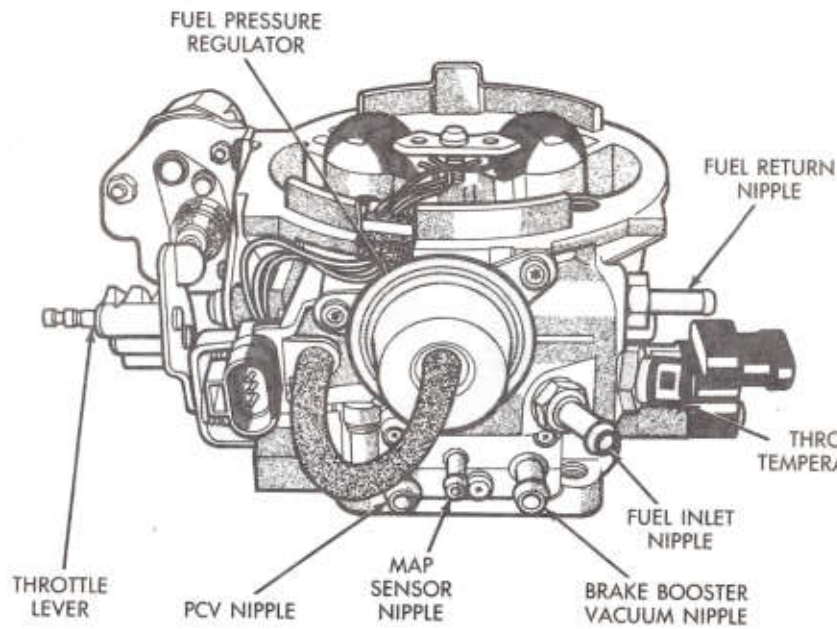
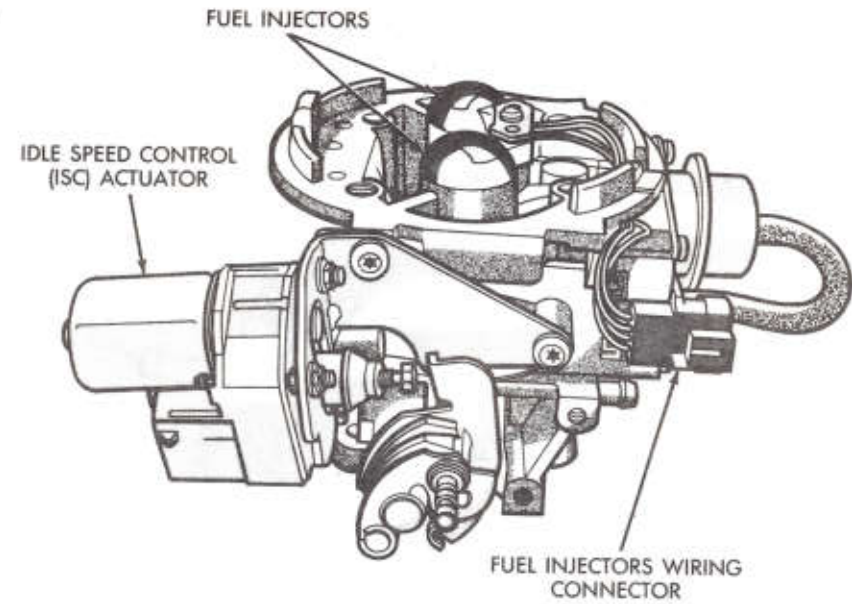
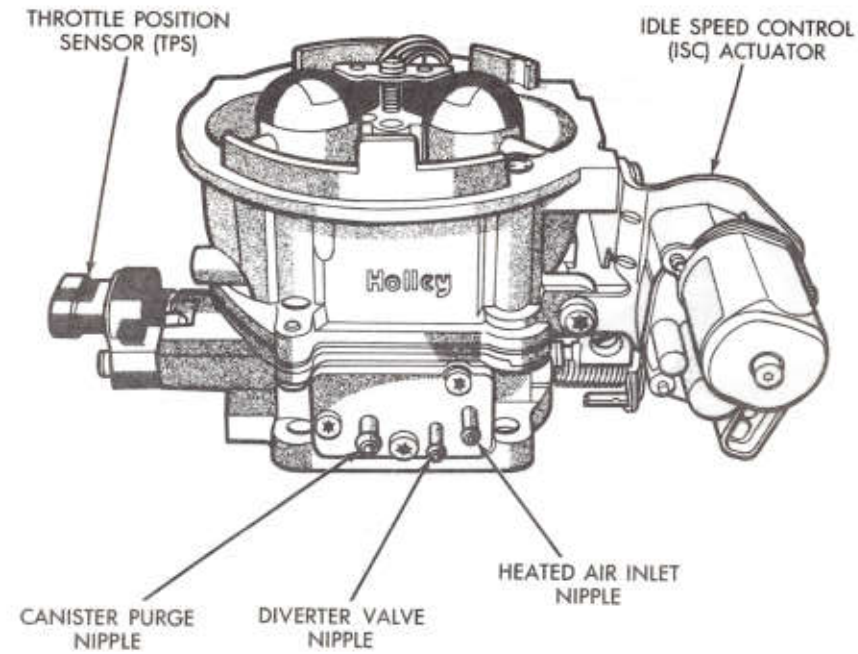
HEATED AIR INLET NIPPLE

FUEL PRESSURE REGULATOR



RR14G207

Fig. 8—Throttle Body 3.9L Engine



RR14G208

Fig. 9—Throttle Body 5.2L Engine

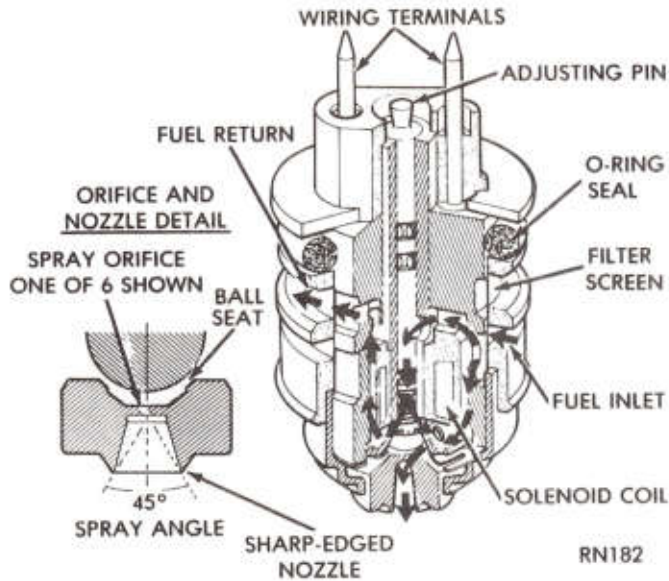


Fig. 10—Fuel Injector

FUEL PRESSURE REGULATOR (Fig. 11)

The pressure regulator is a mechanical device located in the back of the throttle body. Its function is to maintain a constant 100 kPa (14.5 psi.) across the fuel injector tip. The regulator uses a spring loaded rubber diaphragm to uncover a fuel return port. When the fuel pump becomes operational, fuel flows past the injector into the regulator, and is restricted

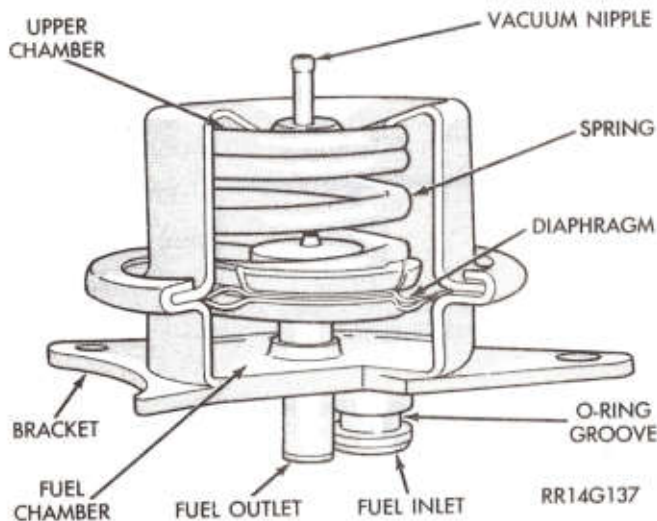


Fig. 11—Fuel Pressure Regulator

from flowing any further by the blocked return port. When fuel pressure reaches 100 kPa (14.5 psi.) it pushes on the diaphragm, compressing the spring, and uncovers the fuel return port. The diaphragm and spring will constantly move from an open to closed position to keep the fuel pressure constant.

THROTTLE POSITION SENSOR (TPS)

The Throttle Position Sensor (TPS) is mounted on the throttle body and senses the angle of the throttle blade opening. A 5 volt signal is supplied to the TPS and a portion of the voltage is sent back to the SMEC based on the position of the throttle blade. The return voltage increases when the blade is opened. The signal supplied by the TPS is used to assist the SMEC in determining the correct air/fuel ratio during varying conditions like acceleration, deceleration, wide open throttle and idle.

IDLE SPEED CONTROL (ISC) ACTUATOR

The idle speed control (ISC) actuator adjusts the idle speed by physically moving the throttle lever. The moving of the throttle lever will change the air flow which results in the SMEC changing the amount of fuel supplied. The ISC compensates for varying engine loads and ambient temperatures.

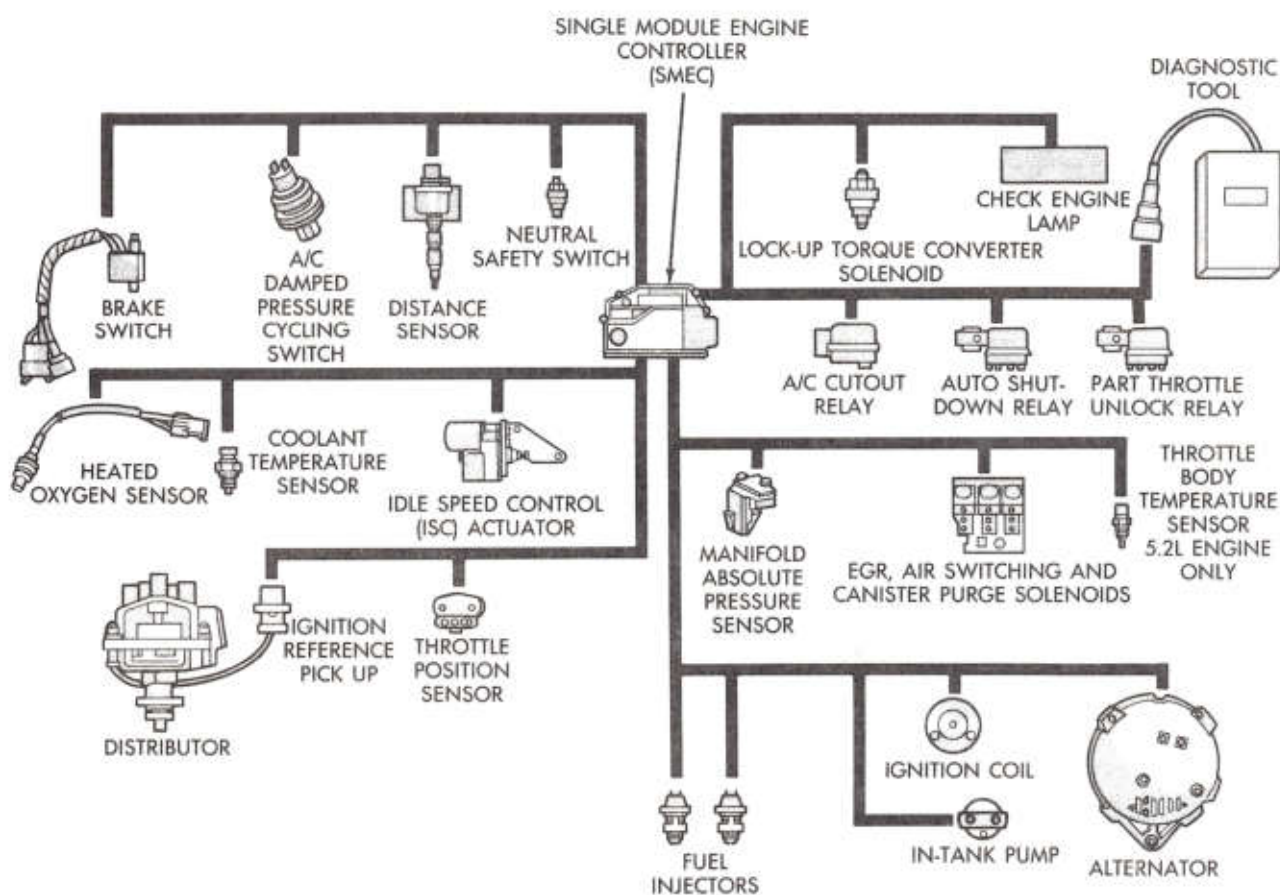
THROTTLE BODY TEMPERATURE SENSOR (5.2L ENGINE)

The throttle body temperature sensor is a device that monitors throttle body temperature which is the same as fuel temperature. It is mounted in the throttle body. This sensor provides information on fuel temperature which allows the SMEC to provide the correct air fuel mixture for a hot restart condition.

GENERAL DIAGNOSIS

INDEX

	Page		Page
Fault Code Description	34	60-Way SMEC Connector	37
On Board Diagnostics	33	3-Way and 1-Way Air Conditioning A/C Clutch Relay Connector	38
System Tests	34	2-Way Air Switching Solenoid Connector	38
Actuator Test Display Codes	35	4-Way Auto Shutdown (ASD) Relay Connector ...	38
Circuit Actuation Test Mode	35	4-Way Idle Speed Control (ISC)	
Engine Running Test Mode	36	Actuator Connector	38
Obtaining Circuit Actuation Test Mode (ATM Test)	35	3-Way Distributor Connector	38
Obtaining Fault Codes	34	2-Way Coolant Temperature Sensor Connector ..	38
Obtaining Sensor Read Test Mode	35	2-Way Distance Sensor Connector	38
Sensor Read Test Display Codes	35	2-Way Canister Purge Solenoid Connector	38
Sensor Test Mode	35	3-Way and 4-Way Heated Oxygen Sensor Connector	38
Switch Test	35	3-Way MAP Sensor Connector	38
Switch Test Mode	34	3-Way Throttle Position Sensor (TPS) Connector .	38
Visual Inspection	29	2-Way EGR Solenoid Connector	38
Wiring Connector Pin Description		2-Way Throttle Body Temperature Sensor Connector	38
14-Way SMEC Connector	36		



RR14G205

Fig. 1—Throttle Body Fuel Injection Components

VISUAL INSPECTION

A visual inspection for loose, disconnected, or mis-routed wires and hoses should be made before attempting to diagnose or service the fuel injection system. A visual check will help spot these faults and save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

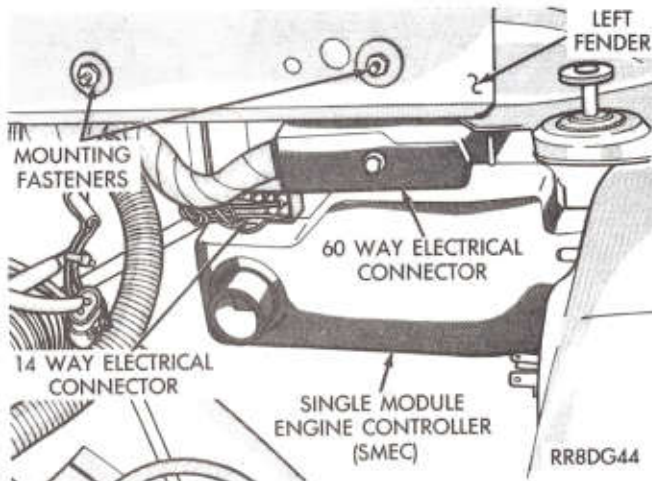


Fig. 2—Single Module Engine Controller (SMEC) Electrical Connectors

(1) Verify that the 60-way connector is fully inserted into the socket on the Single Module Engine Controller (SMEC) (Fig. 2).

(2) Verify that the 14-way connector is fully inserted into the socket on the Single Module Engine Controller (SMEC) (Fig. 2).

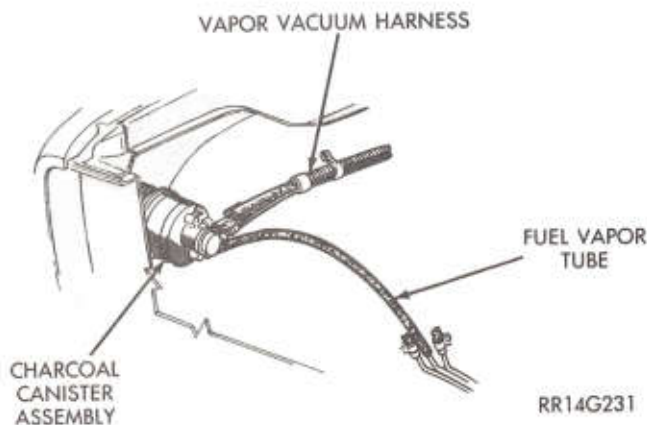


Fig. 3—Vapor Canister

(3) Verify that hoses are securely attached to vapor canister (Fig. 3).

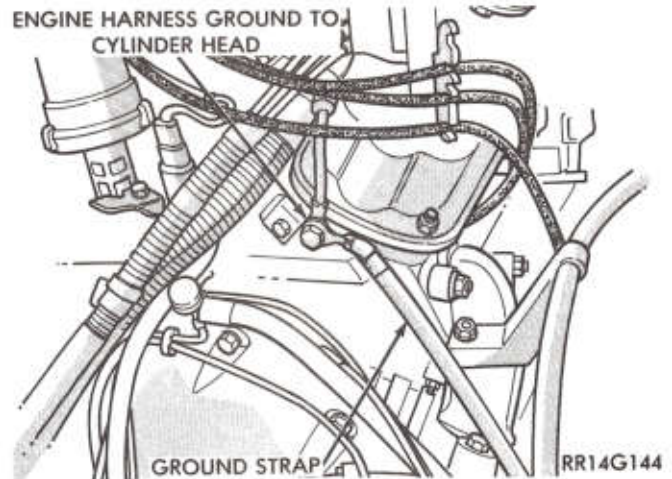


Fig. 4—Engine Ground Strap to Engine

(4) Verify that alternator wiring and belt are correctly installed and tightened.

(5) Verify that engine ground strap is attached at the engine dash panel (Fig. 4).

(6) Verify that the 3-way connector is attached to the MAP sensor (Fig. 5).

(7) Verify M.A.P. Sensor Vacuum Hose is attached at MAP sensor. (Fig. 5).

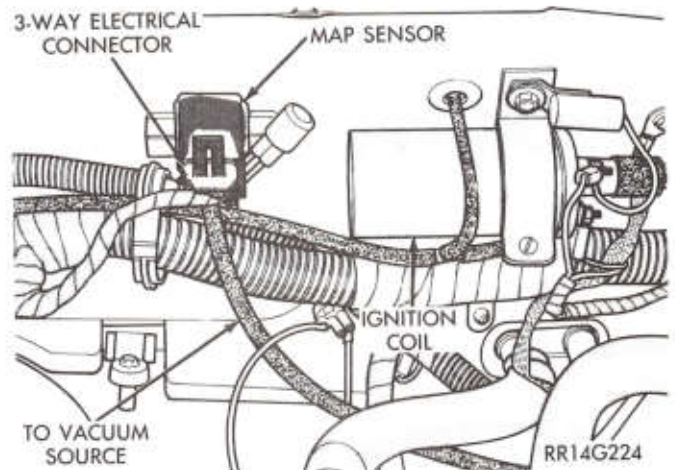


Fig. 5—Map Sensor Electrical and Vacuum Connections

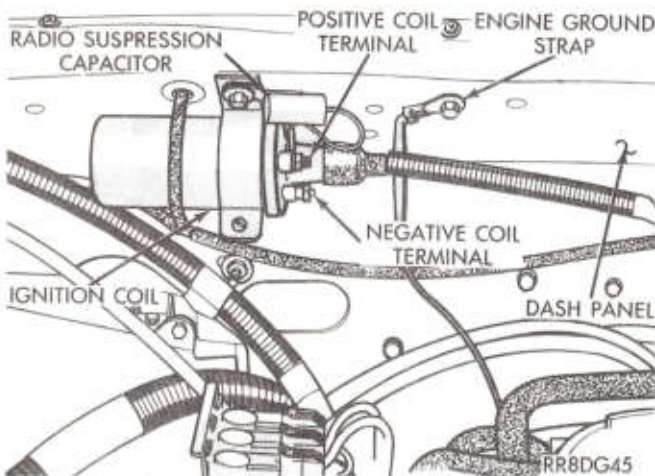


Fig. 6—Ignition Coil Connections

(8) Check Ignition Coil Electrical Connections (Fig. 6).

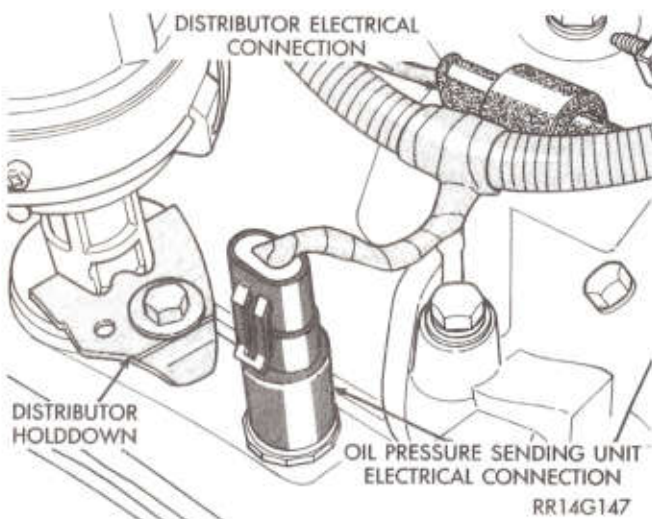


Fig. 7—Distributor, Oil Pressure Switch, and Electrical Connections

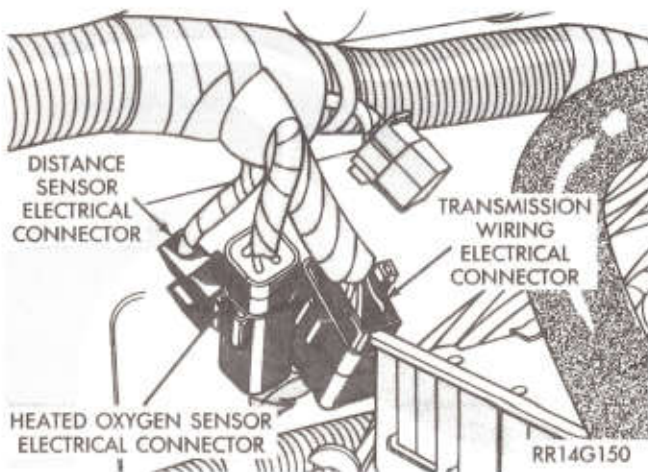


Fig. 8—Heated Oxygen Sensor Electrical Connection 5.2L Engine

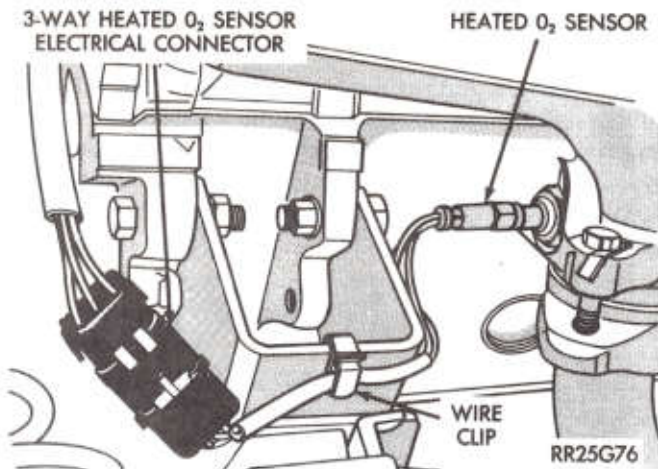


Fig. 9—Heated Oxygen Sensor Electrical Connection 5.2L Engine

(9) Verify that 3-way connector is attached to distributor (Fig. 7).

(10) Verify oil pressure sending unit electrical connections is fully inserted (Fig. 7).

(11) Verify that 4-way connector is attached for heated Oxygen Sensor 3.9L Engine (Fig. 8).

(12) Verify that 3-way connector is attached for Heated Oxygen Sensor 5.2L Engine (Fig. 9).

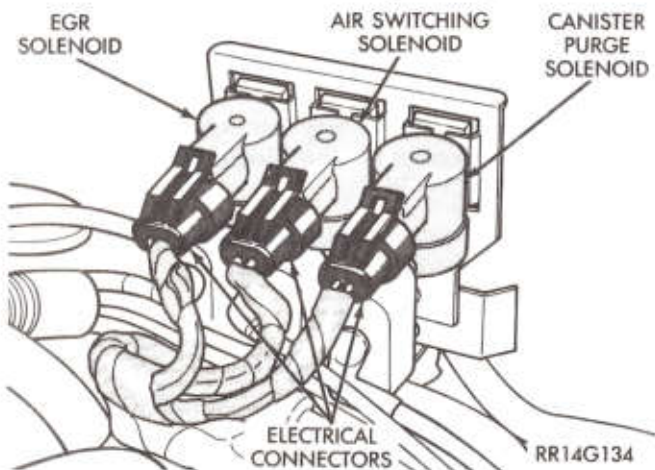


Fig. 10—Electrical Connector Canister Purge Solenoid, Air Switching Solenoid, and EGR Diagnostic Solenoid

(13) Verify that the 2-way connector is attached to the Air Switching Solenoid (Fig. 10).

(14) Verify that the 2-way connector is attached to the Canister Purge Solenoid (Fig. 10).

(15) Verify that the 2-way connector is attached to the EGR Solenoid (Fig. 10).

(16) Verify that vacuum connection at Air Switch Solenoid is secure and not leaking (Fig. 11).

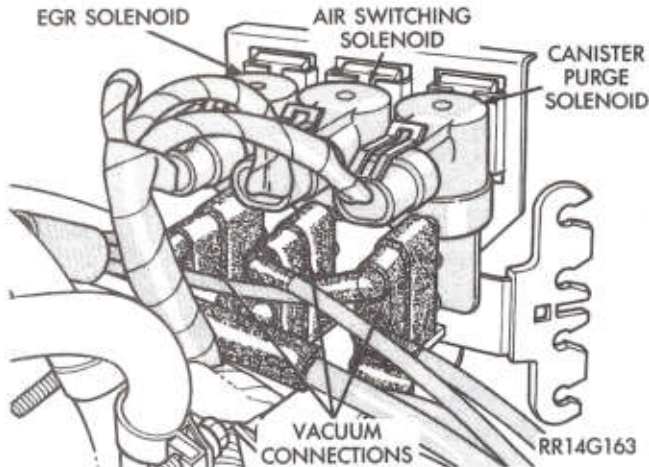


Fig. 11—Canister Purge Solenoid, Air Switching Solenoid, and EGR Solenoid Vacuum Connections

(17) Verify that vacuum connection at Canister Purge Solenoid is secure and not leaking (Fig. 12).

(18) Verify that vacuum connection at EGR Solenoid is secure and not leaking (Fig. 11).

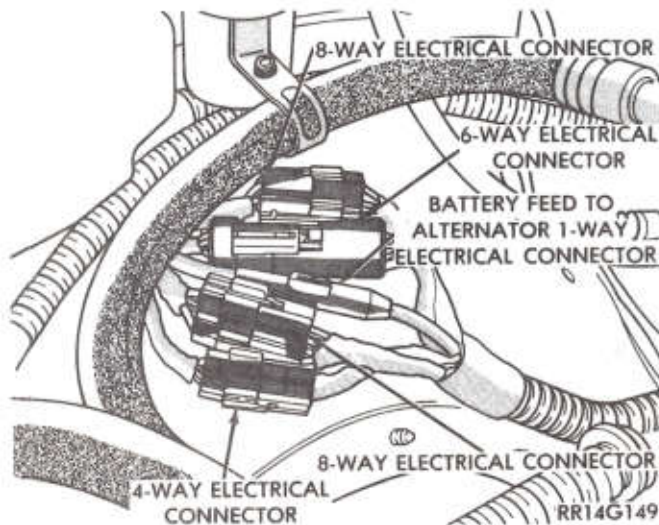


Fig. 12—Engine Harness to Main Harness

(19) Verify engine harness to main harness connections are fully inserted (Fig. 12).

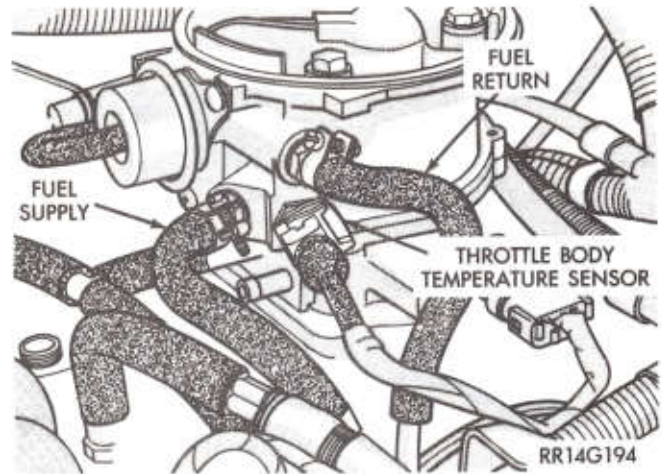


Fig. 13—Throttle Body Temperature Sensor Electrical Connection

(20) Verify that the 2-way connector is attached to the throttle body temperature sensor (Fig. 13).

(21) Verify that the 3-way connector is attached to the throttle position sensor. (Fig. 14).

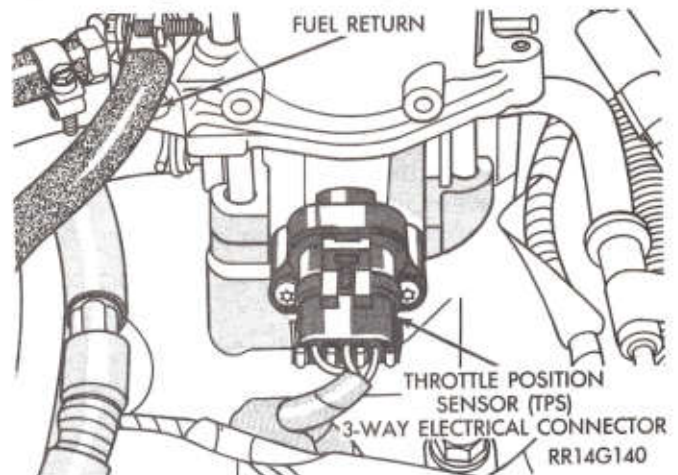


Fig. 14—Throttle Position Sensor (TPS) Electrical Connection

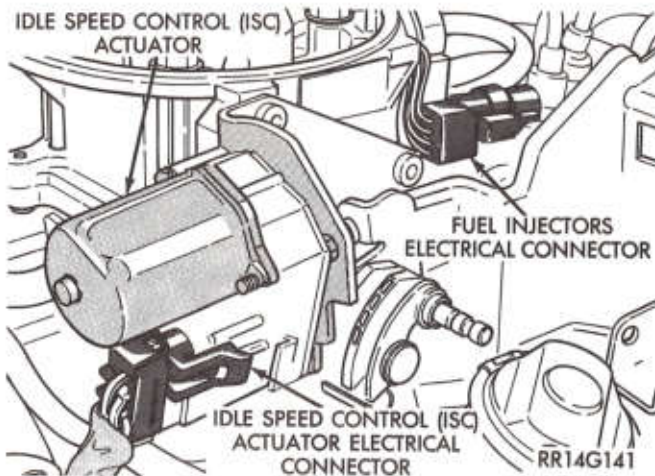


Fig. 15—Throttle Body Wiring Connections

(22) Verify that 4-way connector is attached to (ISC) actuator (Fig. 15).

(23) Verify that the 4-way connector is attached to the fuel injectors harness (Fig. 15).

(24) Verify that vacuum connections on the front and rear of Throttle Body are secure and not leaking (Figs. 16 and 17).

(25) Verify that heated air door vacuum connection is connected and not leaking.

(26) Verify that hose from PCV valve is securely attached to the manifold vacuum port (Fig. 17).

(27) Verify power brake and MAP Sensor vacuum connectors are attached to vacuum ports (Fig. 17).

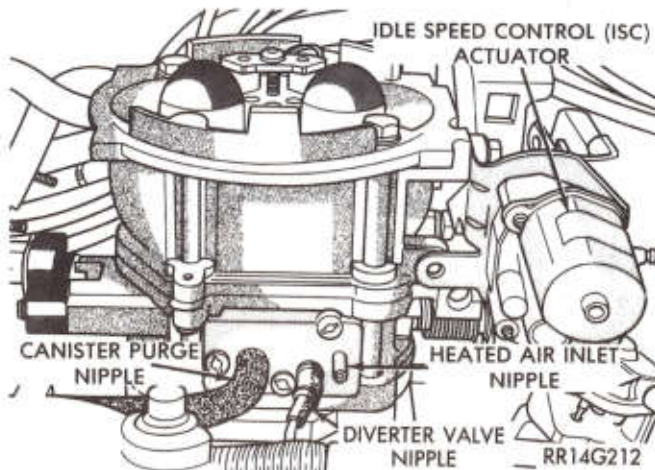


Fig. 16—Throttle Body Vacuum Ports—Front

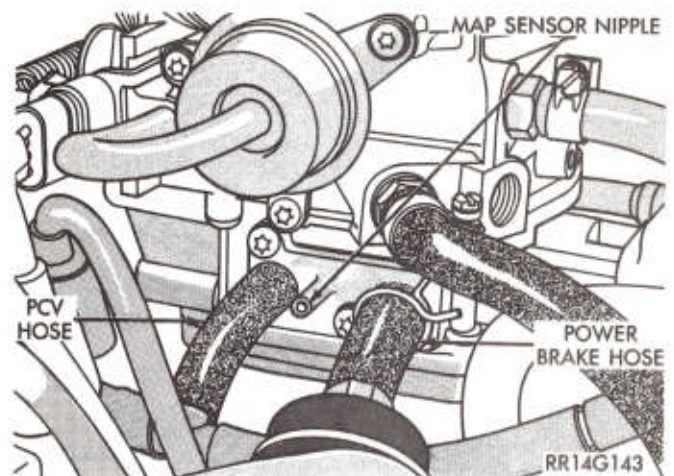


Fig. 17—Throttle Body Vacuum Ports—Rear

(28) Verify that hoses are attached to back pressure transducer (Fig. 18).

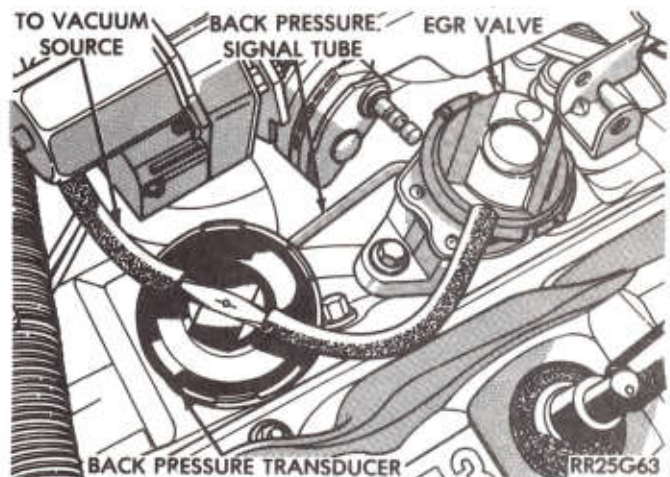


Fig. 18—Backpressure Transducer

(29) Verify that 2-way connector is attached to Coolant Temperature Sensor (Fig. 19).

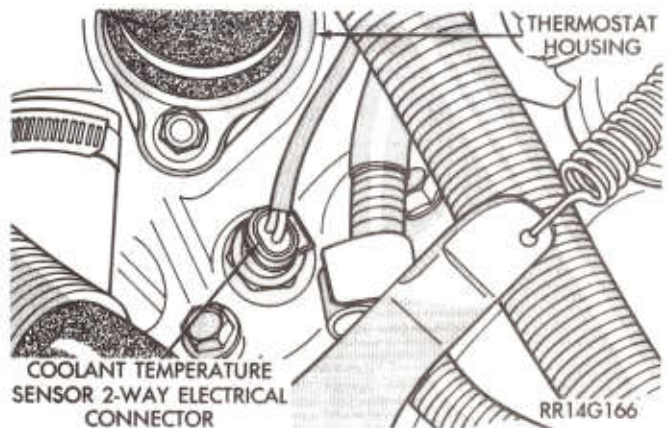


Fig. 19—Coolant Temperature Sensor

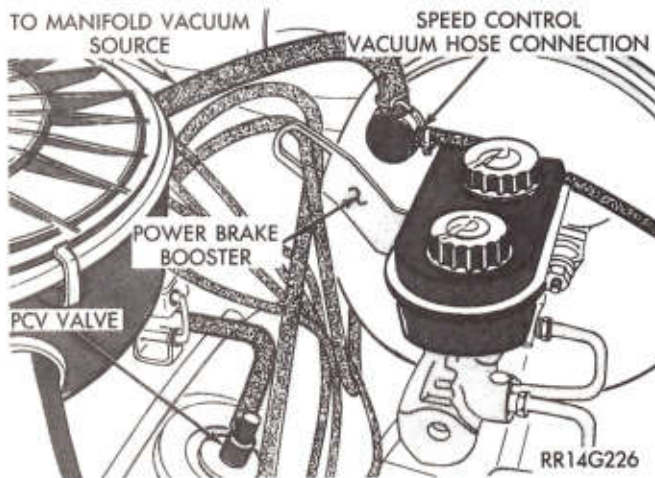


Fig. 20—Power Brake and Speed Control Vacuum Connection

(30) Verify power brake and speed control vacuum connectors are tight (Fig. 20).

(31) Verify that all ignition cables are in correct order and seated into place.

(32) Verify that all electrical connectors are fully inserted into relays (Fig. 21) and that battery connections are clean and tight.

(33) Check two way Distance Sensor Electrical Connector (Fig. 22).

(34) Verify neutral safety switch electrical connector is in place (Fig. 22). Automatic Only.

(35) Check Torque Converter Lockup Solenoid Electrical Connection (Fig. 22) (Automatic only).

(36) Check Hose and Wiring Connections at Fuel Pump. Check that wiring connector is making contact with terminals on pump.

ON BOARD DIAGNOSTICS

The Single Module Engine Controller (SMEC) has been programmed to monitor several different circuits of the fuel injection system. This monitoring is called On Board Diagnosis. If a problem is sensed with a

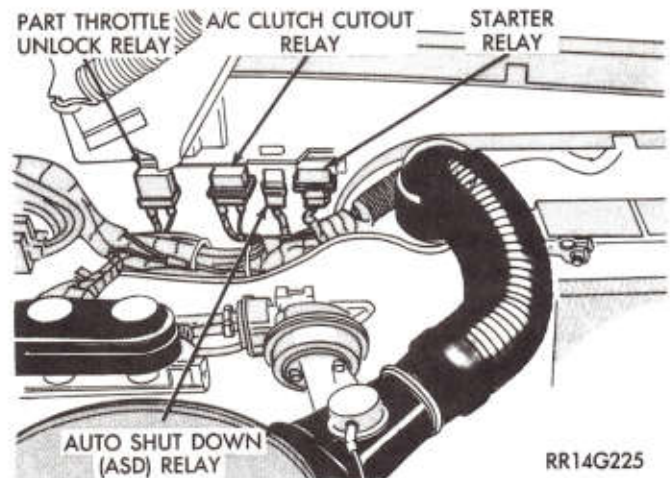


Fig. 21—Engine Compartment Relays

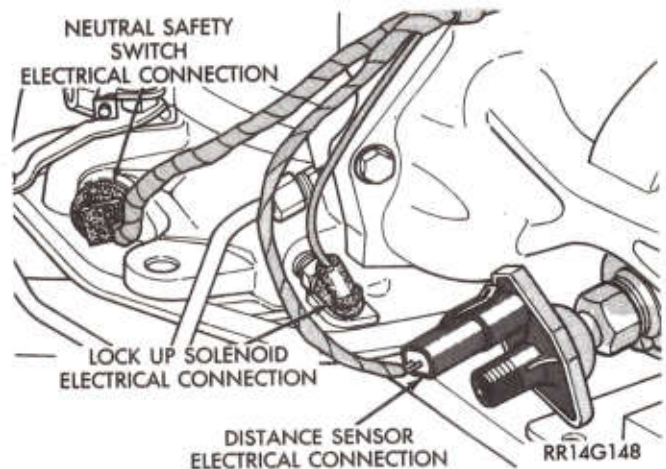


Fig. 22—Transmission Wiring Connections

monitored circuit, often enough to indicate an actual problem, its Fault Code is stored in the SMEC for eventual display to the service technician. If the problem is repaired or ceases to exist, the SMEC cancels the Fault Code after 50 to 100 vehicle key on/off cycles.

FAULT CODE DESCRIPTION

When a fault code appears (either by flashes of the check engine lamp or by watching the Diagnostic Tool, it indicates that the SMEC has recognized an abnormal signal in the system. Fault codes indicate the results of a failure but never identify the failed component directly.

Code 88—Start of test

Code 11—Engine not cranked since battery was disconnected

Code 12—Memory standby power lost

Code 13—MAP Sensor pneumatic circuit***

Code 14—MAP Sensor electrical circuit***

Code 15—Vehicle distance sensor**

Code 16—Loss of battery voltage sense***

Code 17—Engine running to cool refer to Cooling Group 7

Code 21—Oxygen sensor circuit**

Code 22—Coolant temperature sensor circuit***

Code 23—Throttle body temperature sensor circuit

Code 24—Throttle position sensor***

Code 25—ISC motor driver circuit**

Code 26—Peak injector current has not been reached***

Code 27—Fuel Injector Control Problem***

Code 31—Canister Purge solenoid circuit**

Code 32—EGR Diagnostics (Calif. only)**

Code 33—A/C cutout relay circuit

Code 35—Idle Switch Circuit

Code 36—Air Switching Solenoid Circuit**

Code 37—Part Throttle Unlock Solenoid Driver Circuit (Automatic Only)

Code 41—Charging system excess or no field current

Code 42—Auto shutdown relay driver circuit

Code 43—Ignition Coil Control Circuit

Code 44—Loss of FJ2 to Logic Board

Code 46—Battery voltage too high***

Code 47—Battery voltage too low

Code 51—Lean Condition Indicated**

Code 52—Rich Condition Indicated**

Code 53—Internal module problem

Code 55—End of message

* Check Engine lamp on

** Check Engine lamp on (California Only)

*** Check Engine lamp on (All vehicles)

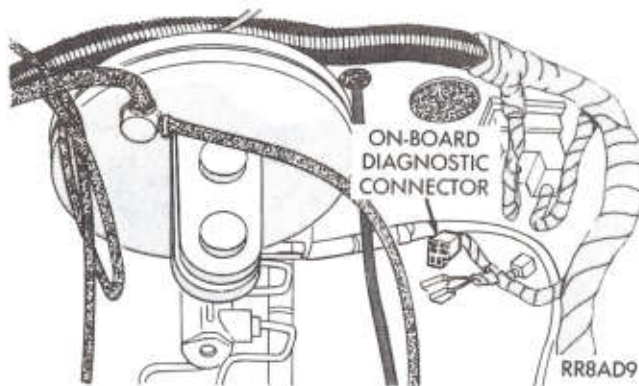


Fig. 23—Diagnostic Connector

SYSTEMS TEST

CAUTION: Be sure to apply parking brake and/or block wheels before performing idle check or adjustment, or any engine running tests.

Obtaining Fault Codes

(1) Connect Diagnostic Tool to the diagnostic connector located in the engine compartment near the SMEC (Fig. 23).

(2) Start the engine if possible, cycle the transmission selector and the A/C switch if applicable. Shut off the engine.

(3) Turn the ignition switch on-off-on-off-on within 5 seconds. Record all the diagnostic codes shown on the Diagnostic Tool, observe the check engine lamp on the instrument panel the lamp should light for 3 seconds then go out (bulb check).

SWITCH TEST MODE

The switch inputs used by the SMEC have only two recognized states, HI and LO. For this reason, the SMEC cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. However, if any one of these subject switches is toggled, the controller does have the capability to respond, indicating that it has recognized a state change. If the change is displayed, it can be assumed that the entire switch circuit to the SMEC is functional.

Switch Test

(1) After all codes have been shown and has indicated Code 55 end of message, actuate the following component switches.

The digital display must change it's numbers between 00 and 88 when the switch is activated and released. The Check Engine Lamp will also blink:

Brake pedal, Idle Contact Switch

Gear shift selector; Park, Reverse, Neutral

A/C switch (Valid only if A/C dampened pressure switch is closed, Blower Switch on.)

CIRCUIT ACTUATION TEST MODE

The purpose of the circuit actuation test mode is to check for the proper operation of output circuits of devices which the SMEC cannot internally recognize. The SMEC can attempt to activate these outputs and allow an observer to verify proper operation. Most of the tests available in this mode provide an audible or visual indication of device operation (click of relay contracts, spray of fuel, etc.) With the exception of an intermittent condition, if a device functions properly during its test, it can be assumed that the device, its associated wiring, and its driver circuit are in working order.

OBTAINING CIRCUIT ACTUATION TEST MODE (ATM TEST)

(1) Put system into Diagnostic Test Mode and wait for code 55 to appear on the display screen.

(2) Press ATM button on tool to activate display. If a specific ATM test is desired, hold the ATM button down until desired test code appears.

The computer will continue to turn the selected circuit on and off for as long as five minutes or until the ATM button is pressed again or if the ignition switch is turned off.

If the ATM button is not pressed again, the computer will continue cycling the selected circuit for five minutes and then shut the system off. Turning the ignition switch off will also shut the test mode off.

ACTUATOR TEST DISPLAY CODES

01—Spark activation—once every 2 seconds

02—Injector activation—once every 2 seconds

03—AIS activation—one step open/one step closed every 4 seconds

05—*AC/WOT cut out relay once every 2 seconds

06—ASD relay activation—once every 2 seconds

07—Purge solenoid activation—one toggle every 2 seconds

*A/C switch must be in the on position to allow actuation.

09—Alternator field control activation—one toggle every 2 seconds

10—Shift indicator lamp (man.) or PTU solenoid (auto) toggled on or off every 2 seconds

11—4-speed overdrive override solenoid toggled every 2 seconds

12—Air switching solenoid toggled every 2 seconds

13—EGR solenoid toggled every 2 seconds

SENSOR TEST MODE

The sensor test mode allows the output of seven sensors and the state of three switches to be displayed on the Diagnostic Tool while the engine is not operating. This provides a means by which the entire circuit for each individual sensor and switch can be checked, including the wiring and single module engine controller (SMEC) circuitry. **Test 10 allows erasure of any stored fault codes.**

OBTAINING SENSOR READ TEST MODE

(1) Put system into diagnostic test mode and wait for code 55 to appear on the display screen.

(2) Press ATM button on tool to activate display. If a specific sensor read test is desired, hold the ATM button down until the desired test code appears.

(3) Slide the Read/Hold switch to the "Hold" position to display the corresponding sensor output level.

SENSOR READ TEST DISPLAY CODES

Examples:

07 Battery voltage—units are volts (Example: Display shows 12 which equals 12 volts.)

Code Description

01 Battery temperature sensor—display number $\div 10$ equals sensor voltage.

02 Oxygen sensor voltage—display number $\div 10$ equals sensor voltage.

03 Throttle body temperature sensor voltage display number $\div 10$ equals sensor voltage.

04 Engine coolant temperature sensor—display number $\times 10$ equals degrees of engine coolant sensor.

05 Throttle position sensor voltage—display number $\div 10$ is sensor voltage.

07 Battery voltage—display number is voltage.

08 Map sensor voltage—display number $\div 10$ is voltage.

10 Fault Code Erase Routine—Display will flash 0's of 4 seconds

ENGINE RUNNING TEST MODE

CAUTION: Be sure to apply parking brake and/or block wheels before performing idle check or adjustment, or any engine running tests.

This system monitors the sensors on the vehicle with check operating conditions while the engine is running. Using the number displayed on the readout box, follow instructions given in test summary for values of each test. The engine running test mode can be performed with the engine idling in neutral with parking on or while driving down the road. With the diagnostic tool read/hold switch in the read position, the engine running test mode is initiated after the engine is started.

To select a test code, the read/hold switch is switched to read and the actuator button depressed until the desired code appears. Release actuator button and switch read/hold switch to hold position. The SMEC will monitor that system test and results will be displayed. Using the test summary chart, the display number must be adjusted as indicated for that test.

Code Description

Oxygen sensor state—Display will toggle between 0 and 1

- 61 Battery temperature sensor—display number $\div 10$ equal volts.
- 62 Oxygen sensor—display number $\div 10$ equals volts.
- 63 Throttle body temperature sensor—display number $\div 10$ equals volts.
- 64 Engine coolant temperature sensor—display number $\times 10$ equals degrees F.
- 65 Throttle position sensor—display number $\div 10$ equals volts.
- 67 Battery voltage sensor—display is volts.
- 68 Manifold vacuum sensor—display is inches (Hg).
- 69 Minimum throttle position sensor—display number $\div 10$ equals volts.
- 70 Minimum airflow idle speed sensor—display number $\div 10$ equals rpm.
- 71 Vehicle speed sensor—display is mph.
- 72 Engine speed sensor—display number $\times 10$ equals rpm.

Throttle Body Minimum Air Flow Check Procedure—Using Test #70

- (1) Warm engine in Park or Neutral
- (2) Hook-up timing check device and Tachometer.
- (3) Check basic timing. Using Procedure in Ignition System Group 8D. Adjust if necessary to specification shown on the EAR Label.
- (4) Connect Diagnostic Tool.
- (5) Restart the engine, allow to idle for at least one minute.
- (6) Using the Diagnostic Tool, go to Engine Run-

ning Test No. 70 (press and hold ATM button with read/hold switch in the read position).

(7) Flip read/hold switch to hold position. The following will then occur:

ISC actuator will retract. The ISC actuator must be disconnected before it bottoms out when in engine running Test 70. This will prevent damage to the ISC actuator.

- Idle spark advance will become fixed.
- Engine RPM will be displayed on Diagnostic Tool in units of $\text{RPM} \div 10$. i.e. display = 95 RPM = $95 \times 10 = 950$.

(This device cannot read above 990 RPM.)

(8) Check idle RPM with tachometer, if idle RPM is within the below specification then the throttle body min. air flow is set correctly.

Odometer Reading:

Mileage (less than 1000 miles)

3.9L 400-650 RPM

5.2L 400-650 RPM

Mileage (greater than 1000 miles)

3.9L 450-650 RPM

5.2L 450-650 RPM

If idle RPM is not within specification replace throttle body.

(9) Shut off engine.

(10) Remove Diagnostic Tool.

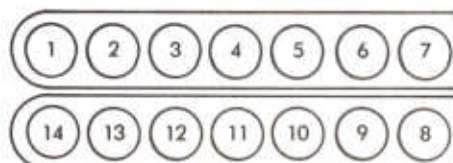
(11) Disconnect timing check device and tachometer.

Ignition Timing Procedure

Refer to Group 8D "Ignition System".

WIRING CONNECTOR PIN DESCRIPTION

14-Way Single Module Engine Controller (SMEC) Connector			
Pin	Circuit	Color	Function
1	N-6	OR	8 Volt Output
2	K-5	BK/WT	Single Ground
3	K-14	DB/WT	FJ2 Output
4	J-2	DB	12-Volt
5	Y-1	GY/WT	Injector Control 2
6	J-9-A	BK	Power Ground
7	J-9B	BK	Power Ground
8	K-16	VT/YL	Injector Control Signal
9	Y-11	WT	Injector Driver #1
10	Y-12	TN	Injector Driver 2
11	R-31	DG/OR	Voltage Regulator Signal
12	J-5	BK/YL	Ignition Coil Driver
13	K-15	YL	Anti Dwell Signal
14	R-3	DG	Regulator Control



TERMINAL
SIDE

RR8DG25

Fig. 24—14-Way (SMEC) Connector

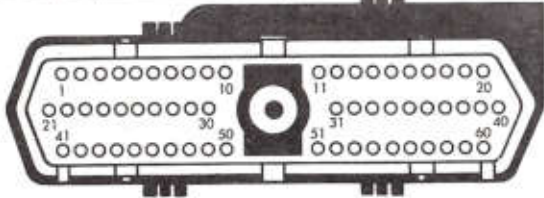
CAV	WIRE COLOR	DESCRIPTION	CAV	WIRE COLOR	DESCRIPTION																																				
1	DG/RD*	MAP SENSOR	37																																						
2			38																																						
3	TN/WT*	COOLANT SENSOR	39	BK/OR*	AIR SWITCHING SOLENOID																																				
4	BK/LB*	SENSOR RETURN	40	GY/YL*	EGR SOLENOID																																				
5	BK/WT*	SIGNAL GROUND	41	RD	DIRECT BATTERY																																				
6			42																																						
7			43																																						
8			44																																						
9			45	BR	A/C CLUTCH INPUT																																				
10	DG/BK*	Z1 INPUT	46																																						
11			47	GY/BK*	REFERENCE PICKUP																																				
12	DB/WT*	FJ2	48	WT/OR*	VEHICLE DISTANCE PICKUP																																				
13	VT/WT*	5-VOLT SUPPLY	49																																						
14	DG/OR*	ALTERNATOR FIELD CONTROL	50																																						
15	LB/RD*	POWR GROUND	51	PK	SCI TRANSMIT																																				
16	LB/RD*	POWER GROUND	52	OR	8-VOLT INPUT																																				
17	BR/WT*	AIS-1	53																																						
18			54	PK/BK*	CANISTER PURGE SOLENOID																																				
19	GY/RD*	AIS-3	55	OR/BK*	LOCK-UP TORQUE CONVERTER OR SHIFT																																				
20					INDICATOR LAMP (MANUAL ONLY)																																				
21	BK/RD	THROTTLE TEMPERATURE SENSOR (5.2L ENGINE ONLY)	56	DB/OR*	A/C WIDE OPEN THROTTLE CLUTCH CUT-OUT																																				
22	OR/DB*	THROTTLE POSITION SENSOR	57																																						
23	BK/DG*	OXYGEN SENSOR	58	DB/YL*	AUTO SHUT DOWN (ASD) RELAY																																				
24			59	BK/PK*	CHECK ENGINE LAMP																																				
25			60																																						
26	VT	CLOSED THROTTLE SWITCH	<table><tr><td colspan="2">WIRE COLOR CODES</td><td>LB</td><td>LIGHT BLUE</td><td>VT</td><td>VIOLET</td></tr><tr><td>BK</td><td>BLACK</td><td>LG</td><td>LIGHT GREEN</td><td>WT</td><td>WHITE</td></tr><tr><td>BR</td><td>BROWN</td><td>OR</td><td>ORANGE</td><td>YL</td><td>YELLOW</td></tr><tr><td>DB</td><td>DARK BLUE</td><td>PK</td><td>PINK</td><td>*</td><td>WITH TRACER</td></tr><tr><td>DG</td><td>DARK GREEN</td><td>RD</td><td>RED</td><td></td><td></td></tr><tr><td>GY</td><td>GRAY</td><td>TN</td><td>TAN</td><td></td><td></td></tr></table>			WIRE COLOR CODES		LB	LIGHT BLUE	VT	VIOLET	BK	BLACK	LG	LIGHT GREEN	WT	WHITE	BR	BROWN	OR	ORANGE	YL	YELLOW	DB	DARK BLUE	PK	PINK	*	WITH TRACER	DG	DARK GREEN	RD	RED			GY	GRAY	TN	TAN		
WIRE COLOR CODES		LB				LIGHT BLUE	VT	VIOLET																																	
BK	BLACK	LG				LIGHT GREEN	WT	WHITE																																	
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DG	DARK GREEN	RD	RED																																						
GY	GRAY	TN	TAN																																						
27																																									
28																																									
29	WT/PK*	BRAKE SWITCH																																							
30	BR/YL*	PARK/NEUTRAL SWITCH																																							
31	LG	SCI RECEIVE																																							
32	GY/WT*	INJECTOR CONTROL 2																																							
33	VT/YL*	INJECTOR CONTROL 1																																							
34	YL	DWELL CONTROL	CONNECTOR TERMINAL SIDE SHOWN																																						
35																																									
36																																									

Fig. 25—60-Way Single Module Engine Controller (SMEC) Wiring Connector

3 and 4-Way Heated Oxygen Sensor Connector

Pin	Circuit	Color	Function
1	N11	18 BK/DG*	Oxygen switching output

2 Coolant Temperature Sensor Connector

Pin	Circuit	Color	Function
1	N5	18 BK/LB*	Sensor ground input
2	K10	20 TN	Sensor signal output

Check Engine Lamp I.P. Printed Circuit Board

Pin	Circuit	Color	Function
1	J2	14 DB	Ignition switch input
2	K3	20 BK/PK*	Ground input

2-Way Distance Sensor Connector

Pin	Circuit	Color	Function
1	N5	18 BK/LB*	Sensor ground input
2	G7	20 WT/OR*	Sensor signal output

3-Way MAP Sensor Connector

Pin	Circuit	Color	Function
1	K8	20 VT	5 volts input
2	K4	20 DG/R*	Sensor signal output
3	N5	18 BK/LB*	Sensor ground input

2-Way Canister Purge Solenoid Canister

Pin	Circuit	Color	Function
1	J2	18 DB	Ignition switch input
2	K1	20 PK/BK*	Solenoid ground input

3-Way Distributor Connector

Pin	Circuit	Color	Function
1	N5	18 BK/LB*	Ground input
2	N6	18 OR	8 volts input
3	N7	18 GY BK*	Signal output

2-Way EGR Solenoid Connector

Pin	Circuit	Color	Function
1	J2	18 DB	Ignition switch input
2	S6	20 GY/YL*	Solenoid ground input

2 Way Air Switching Solenoid Connector

Pin	Circuit	Color	Function
1	J2	14 DB	Ignition switch input
2	N23	20 BK/OR*	Solenoid ground input

3-Way Throttle Position Sensor (TPS) Connector

Pin	Circuit	Color	Function
1	N5	18 BK/LB*	Sensor ground input
2	K7	18 OR/DB*	Sensor signal output
3	K8	20 VT/WT*	5 volt input

4-Way ISC Actuator Connector

Pin	Circuit	Color	Function
1	N1	18 GY/RD*	ISC Actuator
2	N2	18 BR/WT*	ISC Actuator
3	N31	18 VT	ISC Actuator
4	K5	18 BK*	ISC Actuator

3-Way and 1-Way A/C Clutch Relay Connector

Pin	Circuit	Color	Function
1	N13	20 DB/OR*	Ground input
2	C2	14 BK	A/C Damped Pressure Switch
3	J2	14 DB	Ignition switch input
4	C26	18 BR	A/C clutch ground

4-Way Auto Shutdown (ASD) Relay Connector

Pin	Circuit	Color	Function
1	Z1	14 DG/BK*	Ignition and Fuel System Feed
2	K19	20 DB	ASD Signal
3	J1	14 RD	Battery Feed
4	K14	18 DB	Ignition Switch Input

2-Way Throttle Body Temperature Sensor Connector

Pin	Circuit	Color	Function
1	N5	18 BK/LB*	Sensor ground input
2	K13	18 BK/RD*	Sensor signal output

*Denotes tracer

SERVICE PROCEDURES

INDEX

	Page		Page
Air Switching, Canister Purge and EGR Diagnostic Solenoid	46	Installation	39
Fuel Lines and Hoses	39	Idle Speed Control (ISC) Actuator	45
Fuel System Pressure Release	39	Component Disassembly	42
Manifold Absolute Pressure (MAP) Sensor	46	Fuel Fittings	42
Heated Oxygen Sensor (O ₂ Sensor)	47	Fuel Injectors	43
Single Module Engine Controller (SMEC)	46	Fuel Pressure Regulator	42
Throttle Body	39, 42	Throttle Position Sensor (TPS)	44
Removal	39	Throttle Body Temperature Sensor	42
		Vacuum Manifolds	45

FUEL LINES AND HOSES

When servicing the fuel portion of the system, it will be necessary to bleed fuel pressure from the system before removing any clamps or hoses **using fuel system pressure release procedure**. Use care when removing fuel hoses to prevent damage to hose or hose nipple. Always use new hose clamps, of the correct type, when reassembling and torque hose clamps to 1 N·m (10 in. lbs.). Do not use aviation style clamps on this system or hose damage may result.

FUEL SYSTEM PRESSURE RELEASE

The TBI fuel system is under a constant pressure of approximately 100kPa (14.5 psi). Before servicing the fuel pump, fuel lines, fuel filter, throttle body or fuel injector, the fuel system pressure must be released.

- (1) Loosen gas cap to release tank pressure.
- (2) Remove wiring harness connector from injector harness.
- (3) Ground one terminal of injector harness.
- (4) Connect a jumper wire to second terminal and touch the battery positive post for no longer than 10 seconds. This releases system pressure.
- (5) Remove jumper wires.
- (6) Continue fuel system service.

THROTTLE BODY (Fig. 1)

Removal

- (1) Remove air cleaner.
- (2) Perform fuel system pressure release.
- (3) Disconnect negative battery cable.
- (4) Disconnect vacuum hoses and electrical connectors.
- (5) Remove return spring.
- (6) Remove throttle cable and bracket, if so equipped, the speed control cable and transmission kickdown linkages.

- (7) Remove fuel intake and return hoses.
- (8) Remove throttle body mounting screws and lift throttle body from vehicle. Remove throttle body gasket from intake manifold.

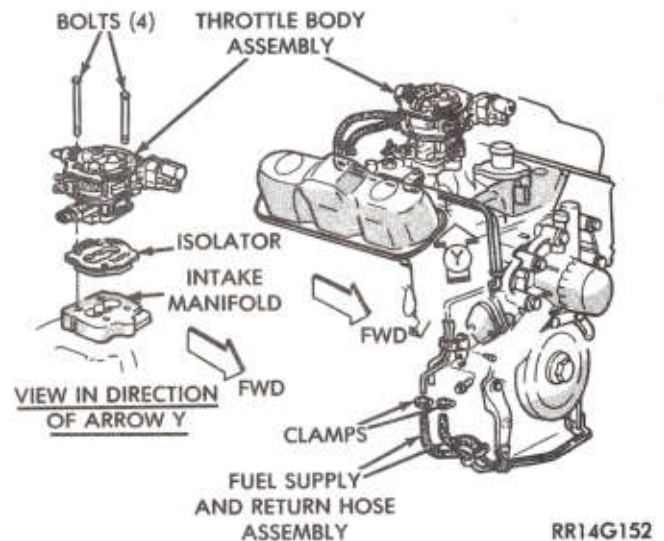


Fig. 1—Throttle Body Removal and Installation

Installation

- (1) Using a new gasket, install throttle body and torque mounting screws to 20 N·m (175 inch-pounds).
- (2) Install fuel intake and return hoses using new original equipment type clamps.
- (3) Install throttle cable and bracket, and if so equipped, install kickdown linkage and speed control cable.
- (4) Install return spring.
- (5) Install wiring connectors and vacuum hoses.
- (6) Install air cleaner.
- (7) Reconnect negative battery cable.

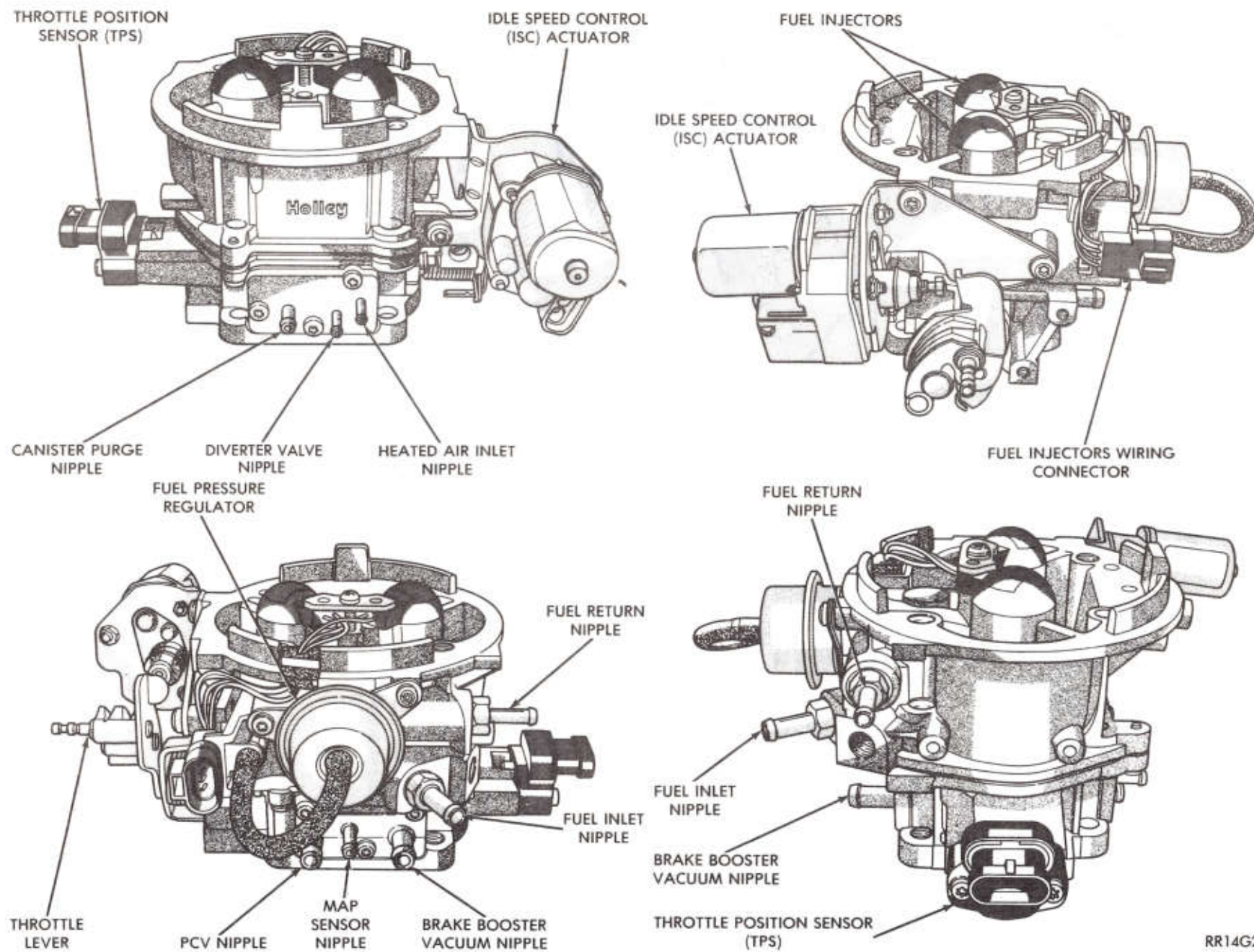


Fig. 2—Throttle Body 3.9L

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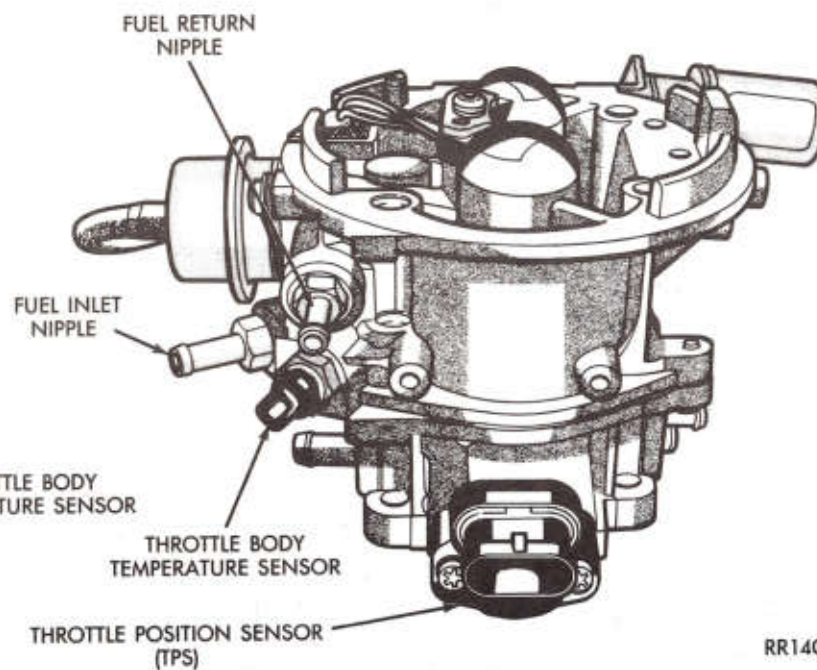
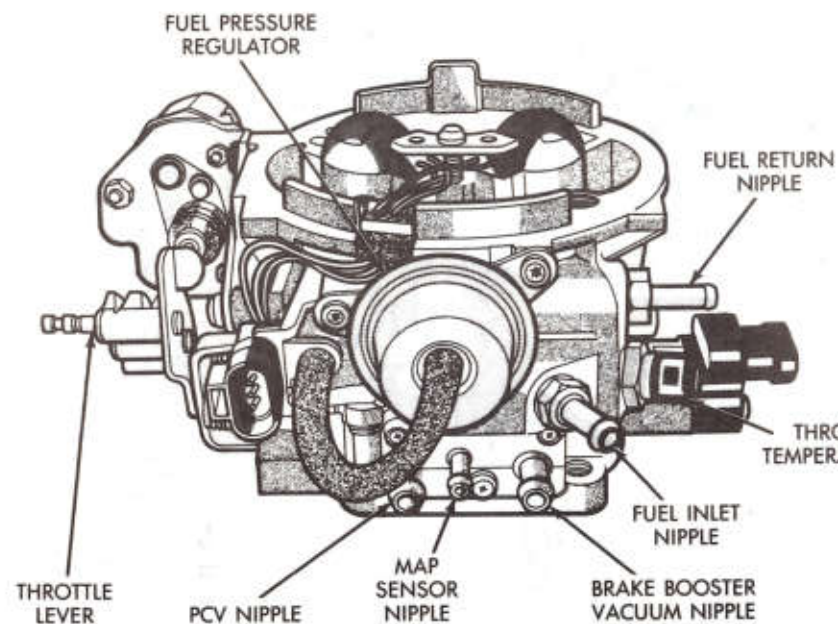
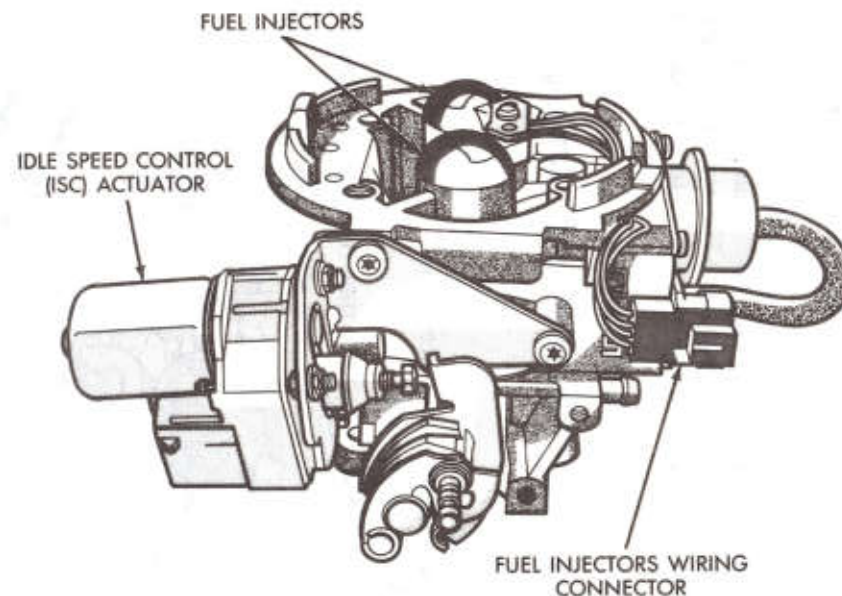
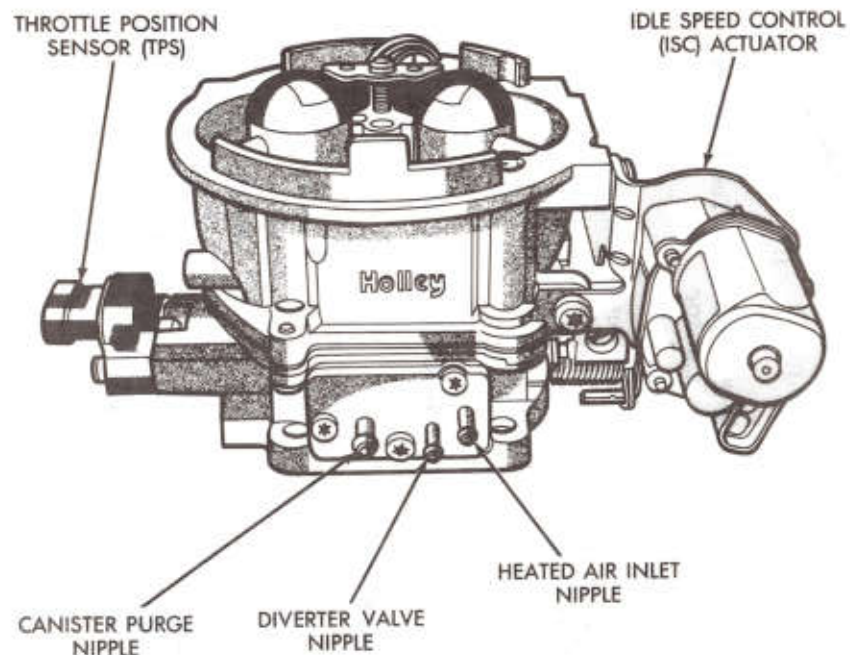


Fig. 3—Throttle Body 5.2L

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THROTTLE BODY (Figs. 2 and 3)

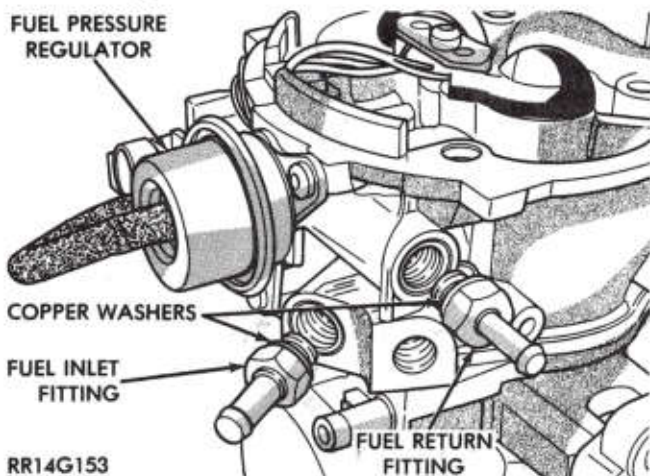
When servicing the fuel portion of the throttle body it will be necessary to bleed fuel pressure before opening any hoses. Always reassemble throttle body components with new O-rings and seals where applicable. Never use silicone lubricants on O-rings or seals, damage may result. Use care when removing fuel hoses to prevent damage to hose or hose nipple. Always use new hose clamps of the correct type when reassembling and torque hose clamps to 1 N·m (10 in. lbs.). Do not use Aviation style clamps on this system or hose damage may result.

Component Disassembly

It is not necessary to remove the throttle body from the intake manifold to perform component disassembly. If fuel system hoses are to be replaced, only hoses marked EFI/EFM may be used.

FUEL FITTINGS (Fig. 4)**Removal**

- (1) Remove air cleaner assembly.
- (2) Perform Fuel System Pressure Release.
- (3) Disconnect negative battery cable.
- (4) Loosen fuel intake and return hose clamps. Wrap a shop towel around each hose, twist and pull of each hose.
- (5) Remove each fitting and note inlet diameter. Remove copper washers.

**Fig. 4—Servicing Fuel Fitting****Installation**

- (1) Replace copper washers with new washers.
- (2) Install fuel fitting in proper ports and torque to 20 N·m (175 in. lbs.).

(3) Using new original equipment type hose clamps, install fuel return and supply hoses. Torque hose clamps to 1 N·m (10 in. lbs.).

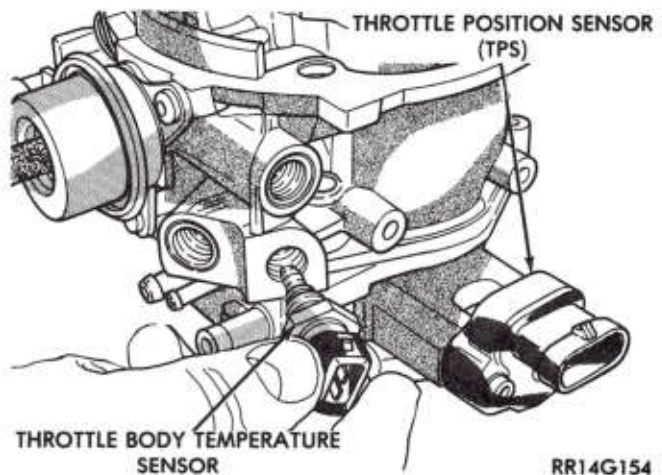
(4) Reconnect negative battery cable.

(5) Test for leaks using Diagnostic Tool. With key in the "Run" position depress the ATM button, this will activate pump and pressurize the system, check for leaks.

(6) Reinstall air cleaner assembly.

THROTTLE BODY TEMPERATURE SENSOR (Fig. 5)**Removal**

- (1) Remove air cleaner.
- (2) Disconnect wiring connector.
- (3) Unscrew sensor.

**Fig. 5—Servicing Throttle Body Temperature Sensor****Installation**

- (1) Apply heat transfer compound (provided) to tip portion of new sensor.
- (2) Install and torque to 100 ± 20 in. lbs.
- (3) Connect wiring connector.
- (4) Install air cleaner.

FUEL PRESSURE REGULATOR (Fig. 6)**Removal**

- (1) Remove air cleaner assembly.
- (2) Perform fuel system pressure release.
- (3) Disconnect negative battery cable.
- (4) Remove vacuum hose from throttle body.
- (5) Remove 3 screws attaching pressure regulator to throttle body. **WARNING: PLACE A SHOP TOWEL AROUND FUEL INLET CHAMBER TO CONTAIN ANY FUEL REMAINING IN THE SYSTEM.**

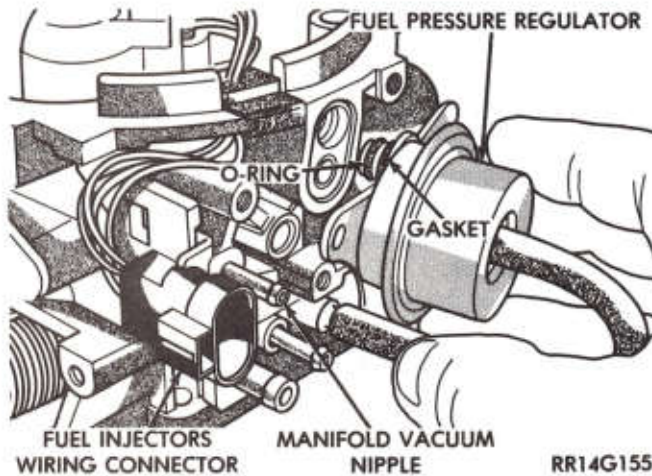


Fig. 6—Servicing Fuel Pressure Regulator

- (6) Pull pressure regulator from the throttle body.
- (7) Carefully remove O-ring from pressure regulator and remove gasket.

Installation

- (1) Place new gasket on pressure regulator and carefully install new O-ring.
- (2) Position pressure regulator on throttle body, press into place, install 3 screws and torque to 5 N·m (40 in. lbs.).
- (3) Install vacuum hose to throttle body.
- (4) Connect battery. Test for leaks using Diagnostic Tool. With key in the "Run" position depress the ATM button, this will activate pump and pressurize the system, check for leaks.
- (5) Reinstall air cleaner assembly.

FUEL INJECTORS (Figs. 7, 8, 9, 10 and 11)

Removal

- (1) Remove air cleaner assembly.
- (2) Perform fuel system pressure release.
- (3) Disconnect negative battery cable.
- (4) Remove Torx screw holding down the injector hold-down clamp. **Be careful of the loose spacer under the clamp (Fig. 7).**
- (5) With a small screwdriver lift the top off the injector using area in front of the hold-down clamp for leverage.
- (6) Using a small screwdriver placed in the hole in the front of the electrical connector gently pry the injector from the pod (Fig. 8).
- (7) Make sure the injector lower O-ring has been removed from the pod (Fig. 9).

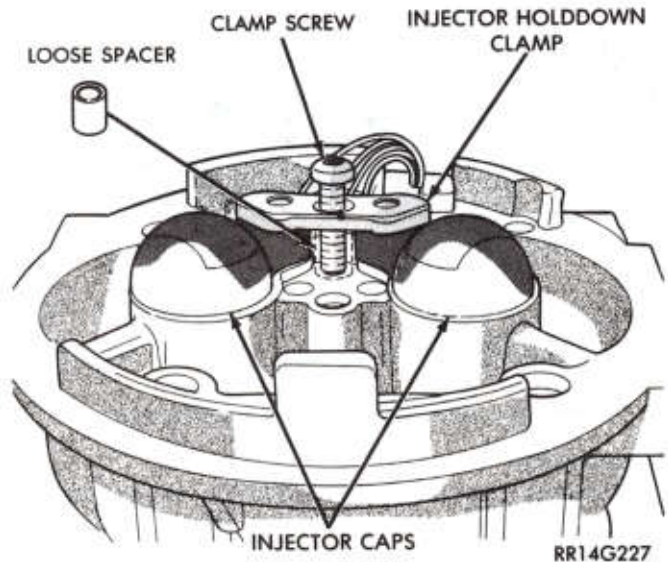


Fig. 7—Removing Injector Cap Hold-down

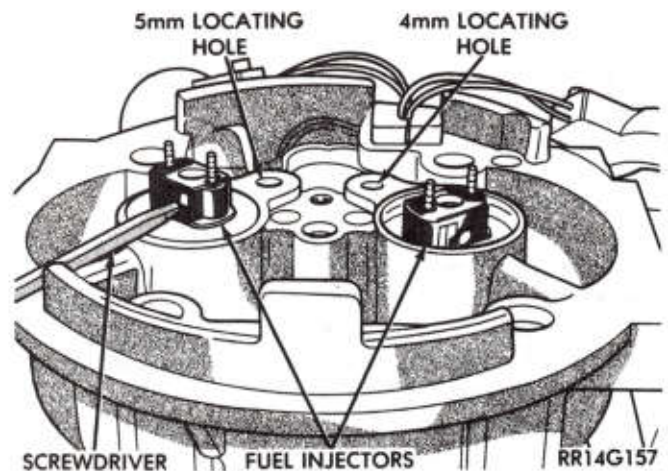


Fig. 8—Removing Fuel Injector

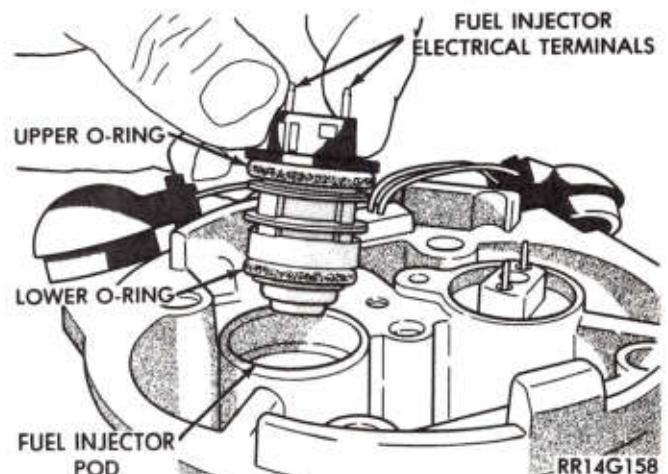


Fig. 9—Servicing Fuel Injector

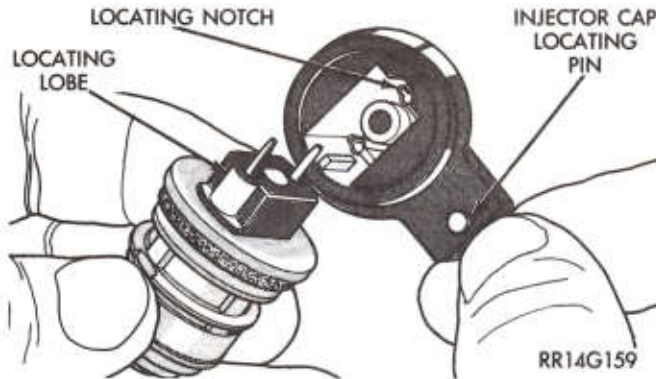


Fig. 10—Fuel Injector and Injector Cap

Installation

- (1) Install lower O-ring or injector. O-ring should butt against plastic filter assembly. Inspect O-ring for cuts or tears and replace if necessary. (Fig. 9).
- (2) Align the injector terminal housing with the locating socket in the injector cap (Fig. 10).
- (3) Press injector into cap so that upper O-ring flange is flush with lower surface of cap. (Fig. 11).
- (4) Spray inner surfaces of both injector pods with Mopar Brake and Carburetor Parts Cleaner (P/N: 4318037) to remove residual gasoline.
- (5) Lightly lubricate the upper and lower O-rings with Petroleum Jelly.
- (6) Place injector and cap in injector pod and align cap locating pin with locating hole in the casting. **Passenger side cap locating pin is 5mm in diameter and will only fit in passenger side locating hole. Driver's side locating pin is 4mm in diameter (Fig. 8).**
- (7) Repeat steps 1-5 with other injector and cap.
- (8) Press firmly on injector caps, one at a time, until cap is flush with casting surface.
- (9) Place injector hold-down clamp with spacer on

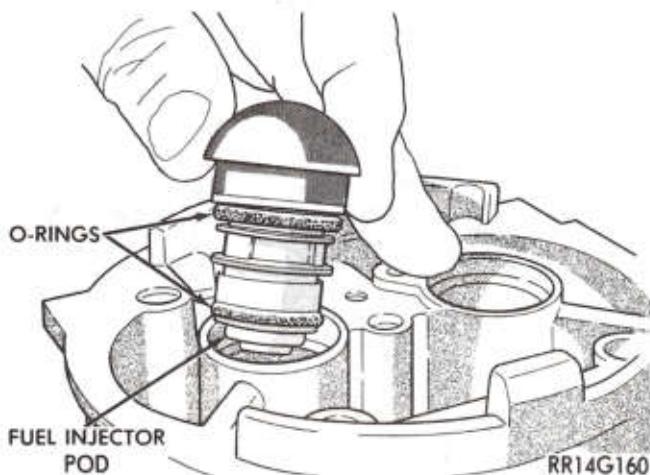


Fig. 11—Installing Fuel Injector Assembly

rear portion of caps, aligning the holes in clamp with pins on caps. (Fig. 7).

(10) Install clamp screw. Be sure spacer is in place (Fig. 7). **Because O-ring squeeze may cause caps to lift up, press firmly on both caps with one hand to assure caps are flush while installing clamp screw.** Tighten screw until snug. Torque screw to 35 in. lbs.

(11) Reconnect battery cable, test for leaks using Diagnostic Tester.

(12) Reinstall Air Cleaner Assembly.

THROTTLE POSITION SENSOR (TPS) (Fig. 12)**Removal**

- (1) Disconnect negative battery cable.
- (2) Remove air cleaner.
- (3) Disconnect 3 way connector at throttle position sensor.
- (4) Remove 2 screws mounting throttle position sensor to throttle body.
- (5) Lift throttle position sensor off the throttle shaft.

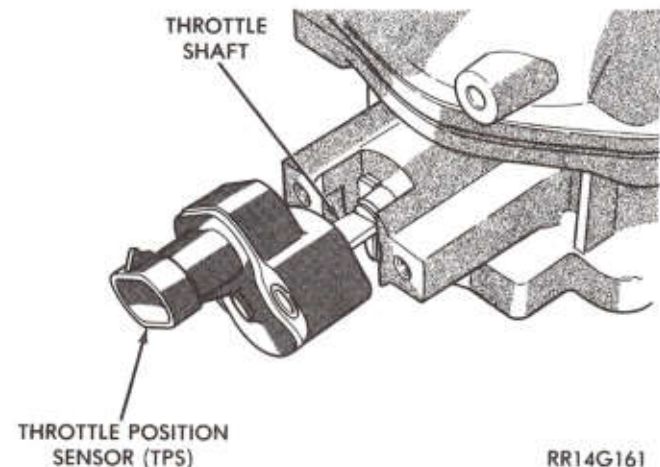


Fig. 12—Servicing Throttle Position Sensor

Installation

- (1) Install throttle position sensor to throttle body, position, upward away from the engine. Torque to 3 N·m (27 in. lbs.).
- (2) Connect 3 way connector at throttle position sensor.
- (3) Install air cleaner.
- (4) Connect battery cable.

IDLE SPEED CONTROL (ISC) ACTUATOR (Figs. 13 and 14)

Removal

- (1) Remove the air cleaner.
- (2) Disconnect the negative battery cable.
- (3) Disconnect the wiring connector.
- (4) Remove the three nuts which hold the idle speed control actuator to the bracket.
- (5) Remove the idle speed control actuator from the bracket.

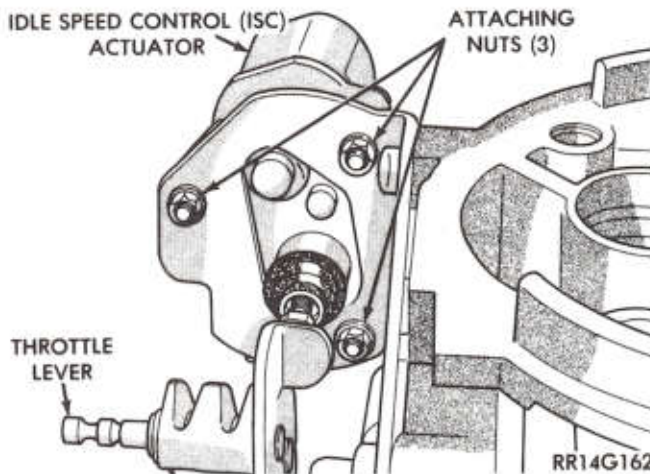


Fig. 13—Idle Speed Control (ISC) Actuator Service

CAUTION: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TESTS.

Installation and Adjustment

- (1) Install the idle speed control actuator to the support bracket with the nuts and washers.
- (2) Attach the wiring connector.
- (3) Start the vehicle and allow to run for two minutes.
- (4) Shut off vehicle, allow 60 seconds for the throttle kicker to fully engage.
- (5) Disconnect the wiring connector to the idle speed control actuator.
- (6) Disconnect the wiring connector to the coolant temperature sensor.
- (7) Hook up a tachometer to the engine.
- (8) Start the vehicle.
- (9) Adjust the extension screw on the throttle kicker until the RPM is within the specifications shown:

Mileage (less than 1000 miles)

3.9L Engine 2400-2500 RPM

5.2L Engine 2650-2750 RPM

Mileage (greater than 1000 miles)
3.9L Engine 2500-2600 RPM
5.2L Engine 2750-2850 RPM

- (10) Shut off vehicle.
- (11) Reconnect the throttle kicker connector.
- (12) Reconnect the Coolant Temperature Sensor.

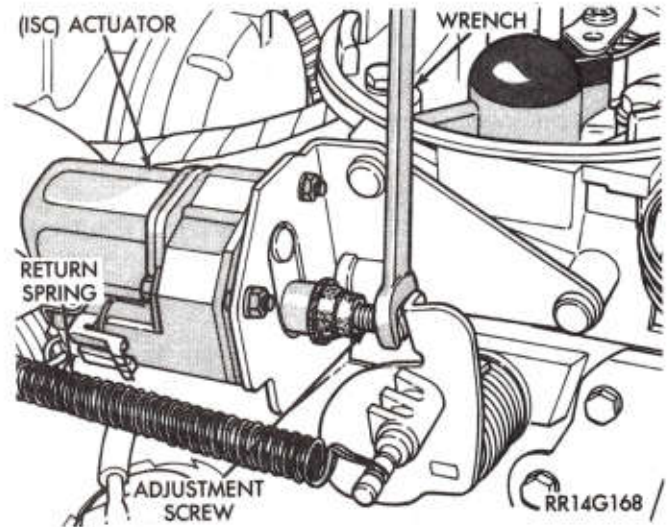


Fig. 14—Adjusting the Idle Speed Control (ISC) Actuator

VACUUM MANIFOLD REMOVAL (Fig. 15)

Removal

- (1) Remove the air cleaner.
- (2) Disconnect negative battery cable.
- (3) Remove the throttle body as described in Throttle Body Removal of this section.
- (4) Remove the three screws which retain the vacuum manifold.
- (5) Remove manifold and remove any gasket material from surface of the throttle body.

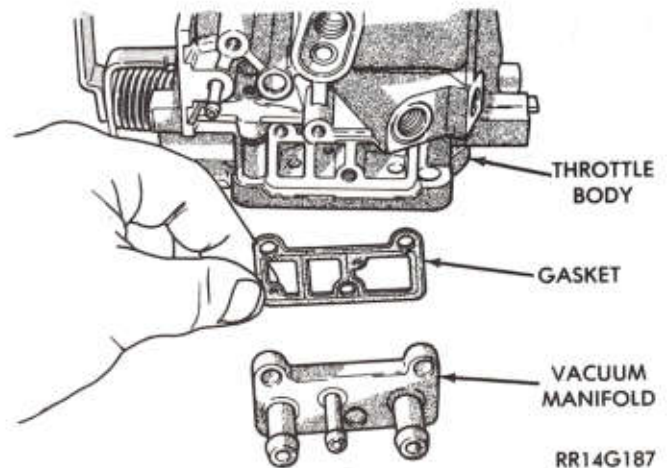


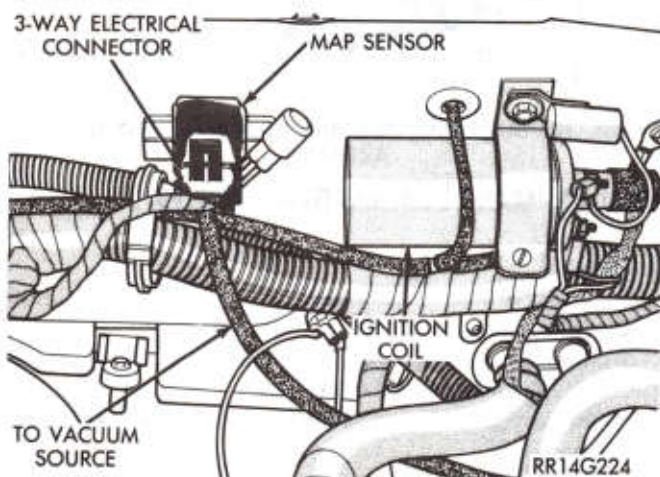
Fig. 15—Servicing Vacuum Manifold

Installation

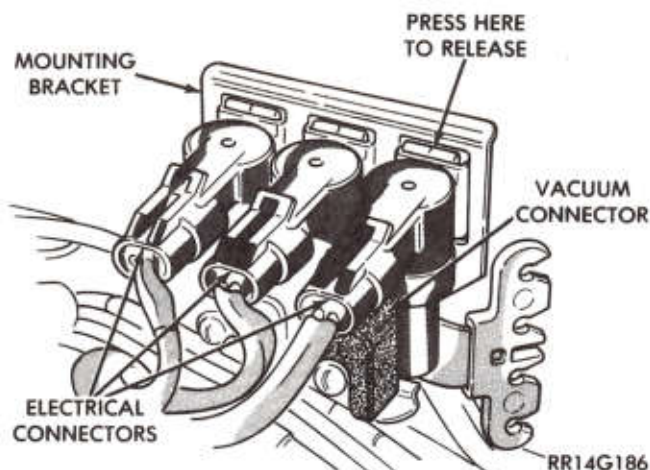
- (1) Install vacuum manifold with a new gasket.
- (2) Torque the attaching screws to 4 N·m (35 in. lbs.).
- (3) Install the throttle body as described in Throttle Body Installation of this section, use a new base gasket when installing the throttle body.
- (4) Install the air cleaner.
- (5) Connect the negative battery cable.

MANIFOLD ABSOLUTE PRESSURE SENSOR REMOVAL (Fig. 16)

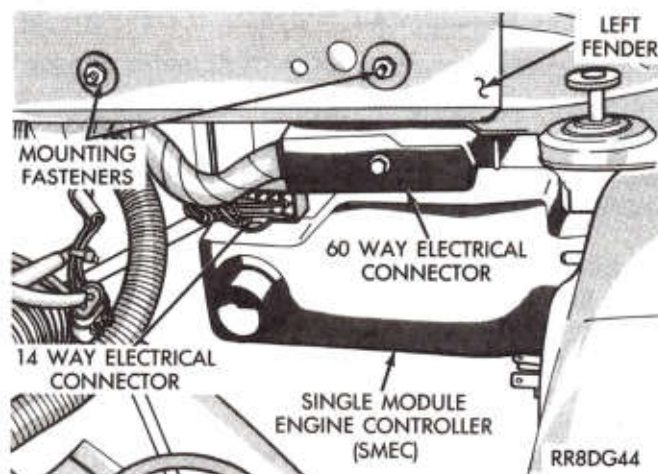
- (1) Remove vacuum hose and electrical connector from sensor.
- (2) Push down on Mounting Clip and remove sensor.
- (3) Reverse the above procedure for installation. Check the vacuum hose and electrical connections to the sensor.

**Fig. 16—Servicing MAP Sensor****AIR SWITCHING, CANISTER PURGE AND EGR DIAGNOSTIC SOLENOID REMOVAL (Fig. 17)**

- (1) Remove vacuum hose and electrical connector from solenoids.
- (2) Remove mounting fastener and remove solenoid pack.
- (3) Depress tab on top of solenoid to be replaced and slide the solenoid downward out of mounting bracket.
- (4) Reverse above procedure to install.

**Fig. 17—Servicing the Solenoid Pack****SINGLE MODULE ENGINE CONTROLLER (SMEC) REMOVAL (Fig. 18)**

- (1) Remove air cleaner duct from SMEC.
- (2) Remove three (3) module mounting screws.
- (3) Remove wiring connectors from module and remove module.
- (4) Reverse the above procedure for installation.

**Fig. 18—Single Module Engine Controller (SMEC)**

HEATED OXYGEN SENSOR (O₂ SENSOR)

Service (Figs. 19, 20 and 21)

Disconnect engine harness lead from Sensor.

CAUTION: Care should be exercised so that no pulling force is put on sensor wire. Use care in working around sensor as the exhaust system may be extremely hot.

The oxygen sensor is located in the exhaust manifold on 5.2L engines and in the exhaust "Y" pipe on the right side of the vehicle on 3.9L engines. Remove sensor using Tool C-4907. For Heated O₂ Sensors. When the sensor is removed, the threads must be cleaned with an 18mm × 1.5 × 6E tap. If the same sensor is to be reinstalled, the sensor threads must be coated with an anti-seize compound such as Loctite 771-64 or equivalent. New sensors are packaged with compound on the threads and no additional compound is required. Sensors must be torqued to 27 N·m (20 foot pounds).

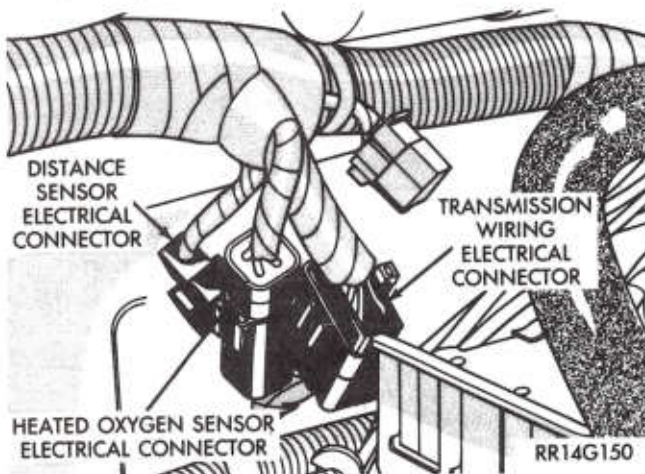


Fig. 19—Heated Oxygen Sensor Electrical Connection 3.9L Engine

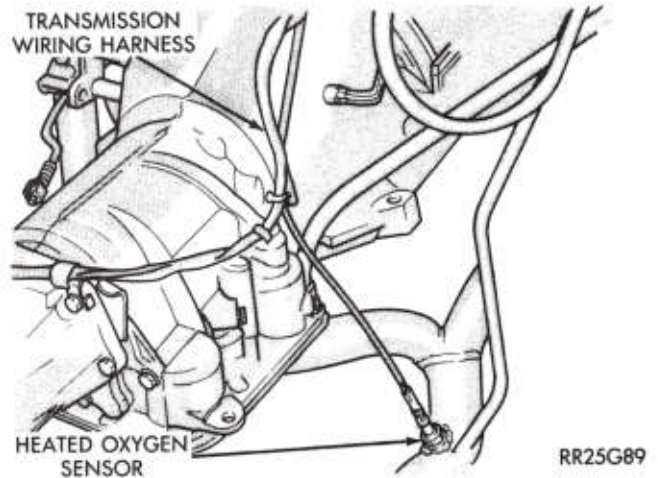


Fig. 20—Heated Oxygen Sensor Location 3.9L Engine

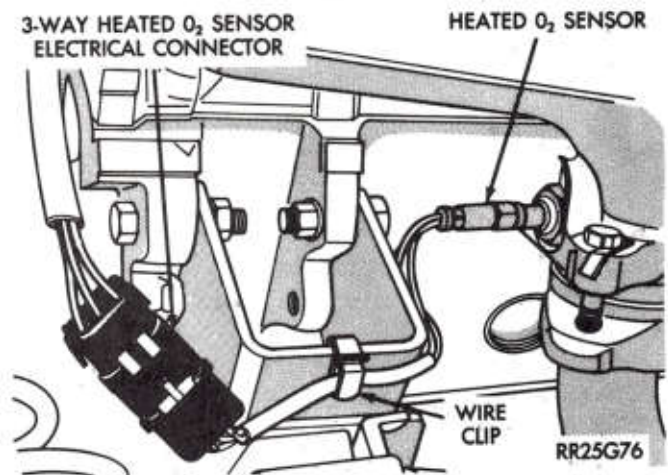


Fig. 21—Heated Oxygen Sensor Location and Electrical Connection 5.2L Engine

DRIVEABILITY SYMPTOM DIAGNOSIS

INDEX

Cold Starting Symptom	Page 48
Cold Engine Driveability Symptom	48
Surge at Constant Speed	49

Warmed Up Driveability Symptom	Page 48
Fuel System Diagnosis	50

COLD STARTING SYMPTOM

Engine Cranks but will not start:

- (1) Choke not closing — check binding or interferences hot and cold and with accessories on.
- (2) No ignition firing.

Engine Fires, runs up, then dies:

- (1) Choke vacuum kick setting too wide.
- (2) EGR system on at start — check CVS5P valve or CTS switch timer, and solenoid for proper operation — Also EGR valve.
- (3) Fast idle speed set too low or cam index incorrect.
- (4) Vacuum leak.
- (5) Inadequate fuel pump output.
- (6) Low fuel level in carb — reset floats.

Engine dies on kickdown after start:

- (1) Check vacuum kick, cam index, hot fast idle speed mis-set.

Engine fires, runs up, then idles slowly with black smoke:

- (1) Choke vacuum diaphragm leaks or is not receiving vacuum signal.
- (2) Choke vacuum kick setting too tight.
- (3) Cam index and/or hot fast idle mis-set too low.
- (4) EGR system on during warmup — check CVS5P or CTS and timer.

Engine fires, but does not run up and dies when key is released:

- (1) Choke vacuum diaphragm leaks or is not receiving vacuum signal.
- (2) Choke linkage binding preventing proper closing or breathing of blade.
- (3) Timing mis-set.

COLD ENGINE DRIVEABILITY SYMPTOM

Engine Stalls when transmission is placed in gear:

- (1) Improper choke vacuum kick setting.
- (2) Fast Idle speed or cam index mis-set.
- (3) Ignition timing — vacuum advance.

Engine stalls, hesitates or sags during acceleration tip-ins during first mile:

- (1) Choke vacuum kick setting.
- (2) Exhaust Manifold Heat Control Valve stuck open.
- (3) Choke control switch in high heat at low ambients.
- (4) Incorrect float heights — low fuel level.
- (5) EGR on during warm-up — defective CVS5P or CTS.
- (6) Weak or low output, carburetor accelerator pump.
- (7) Secondary lockout mis-set — 4 bbl. carb.
- (8) No vacuum advance.

Engine hesitates or sags, stalls after first mile of warmup:

- (1) Choke control switch in high heat at lower ambients.
- (2) Exhaust Manifold Heat Control Valve stuck open.
- (3) Weak or poor output accelerator pump.
- (4) Incorrect float heights — low fuel level.
- (5) EGR on during warmup — defective CVS5P or CTS (low ambients).
- (6) Ignition system-vacuum advance, etc.
- (7) Heated air inlet in cold position (Icing).

WARMED UP DRIVEABILITY SYMPTOM

Hesitation, sag, stumble: (with slight accelerator pedal movement)

- (1) Vacuum leak — hose off or misrouted or split.
- (2) Mis-set timing or defective distributor governor or vacuum advance.
- (3) Weak or defective accelerator pump in carburetor-output to only one bore results in backfire on 4-bbl. carburetor.
- (4) Incorrect float height in carb—low fuel level.
- (5) Sticking or binding carburetor power valve—(Holley) or metering rod carrier binding or sticking (Carter).
- (6) Heated inlet air stuck in either full hot or full cold position, due to binding door hinge or faulty sensor.

(7) Carburetor transfer or idle system plugged or obstructed.

(8) Binding, bent or defective EGR valve or control system, resulting in excessive EGR rates.

Hesitation, sag, stumble: (with heavy accelerator pedal movement)

- (1) Weak or defective accelerator pump.
- (2) Major vacuum leak.
- (3) Sticking or binding carburetor power valve or step-up rods.
- (4) Mis-set basic timing or distributor governor advance faulty.
- (5) Mis-set carburetor float levels—low fuel.
- (6) Faulty fuel pump—obstructed lines or filter.
- (7) Binding or bent carburetor float arms—inadequate fuel.
- (8) Mis-set air valve spring tension on 4-bbl. carburetors causing premature opening.

SURGE AT CONSTANT SPEED

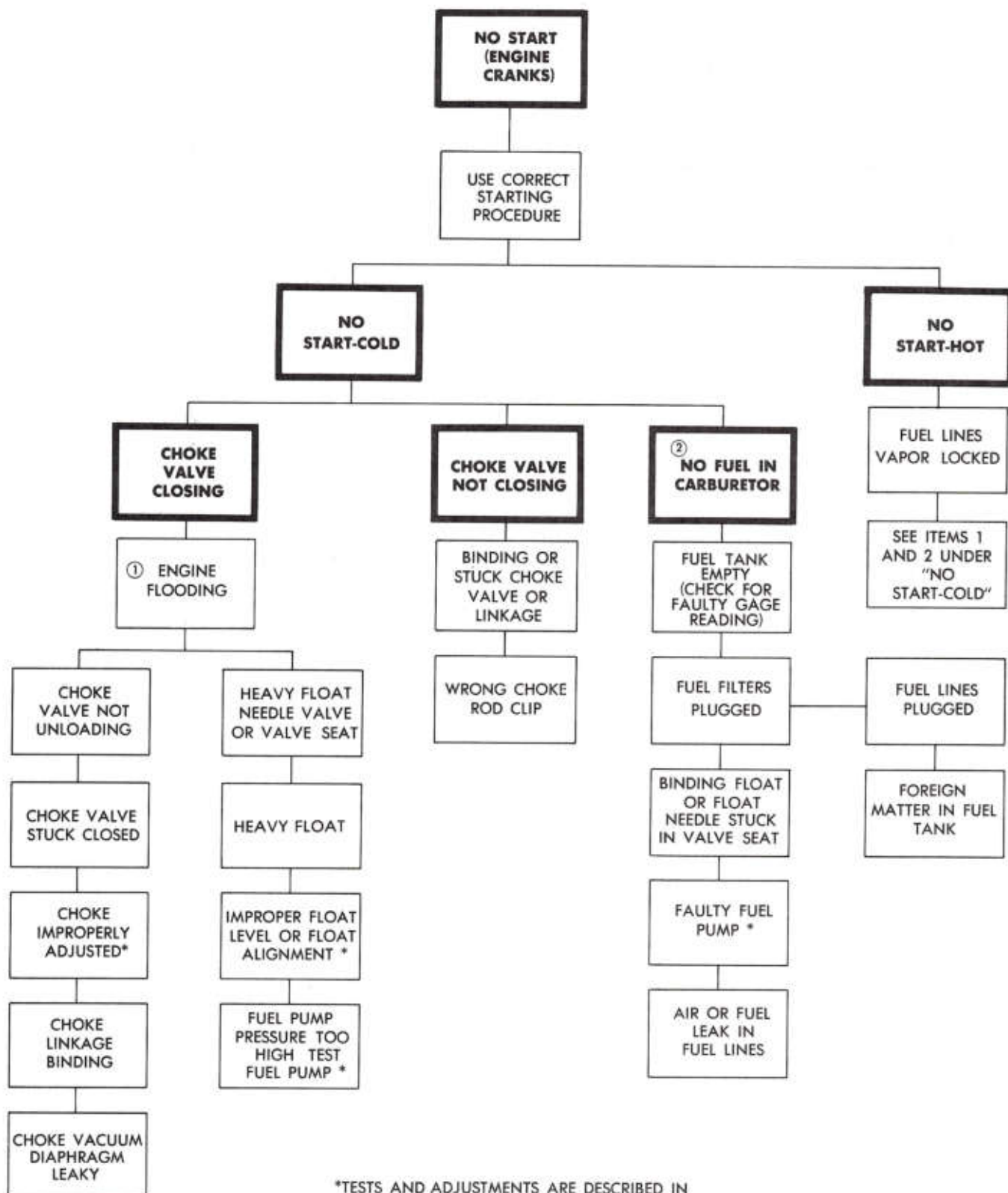
Low Speed

- (1) Vacuum leak—hoses off.
- (2) Mis-set timing—failed vacuum advance.
- (3) Partially plugged idle or transfer system in carb—including mis-set idle.
- (4) Incorrect float setting—low fuel level.
- (5) Defective PCV—stuck in high flow position.
- (6) Heated air system stuck in cold position at low ambient.

High Speed

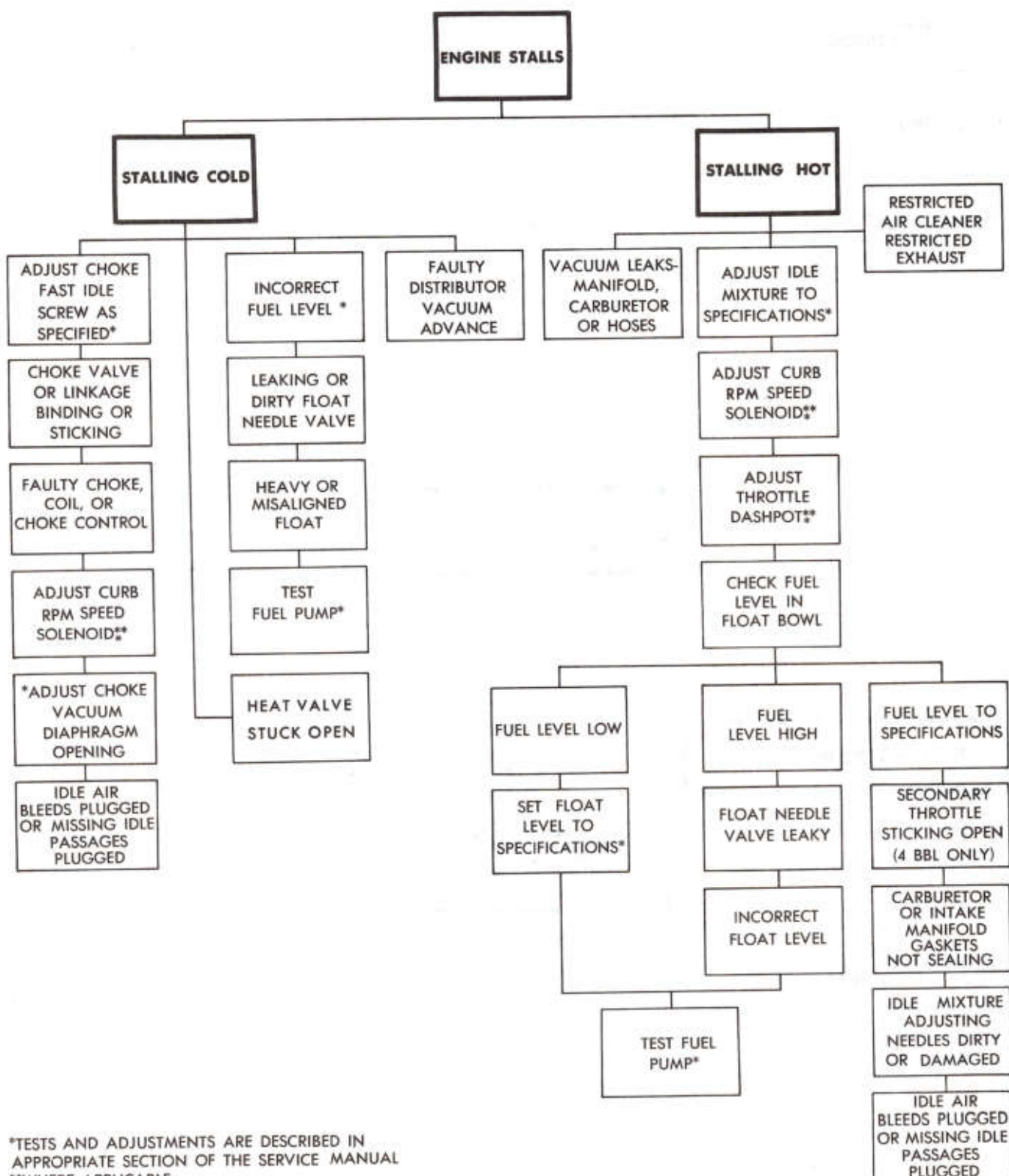
- (1) Incorrect spark advance—defective distributor.
- (2) Major vacuum leak.
- (3) Incorrect float setting—low fuel level.
- (4) Restricted fuel supply.

FUEL SYSTEM DIAGNOSIS PART 1

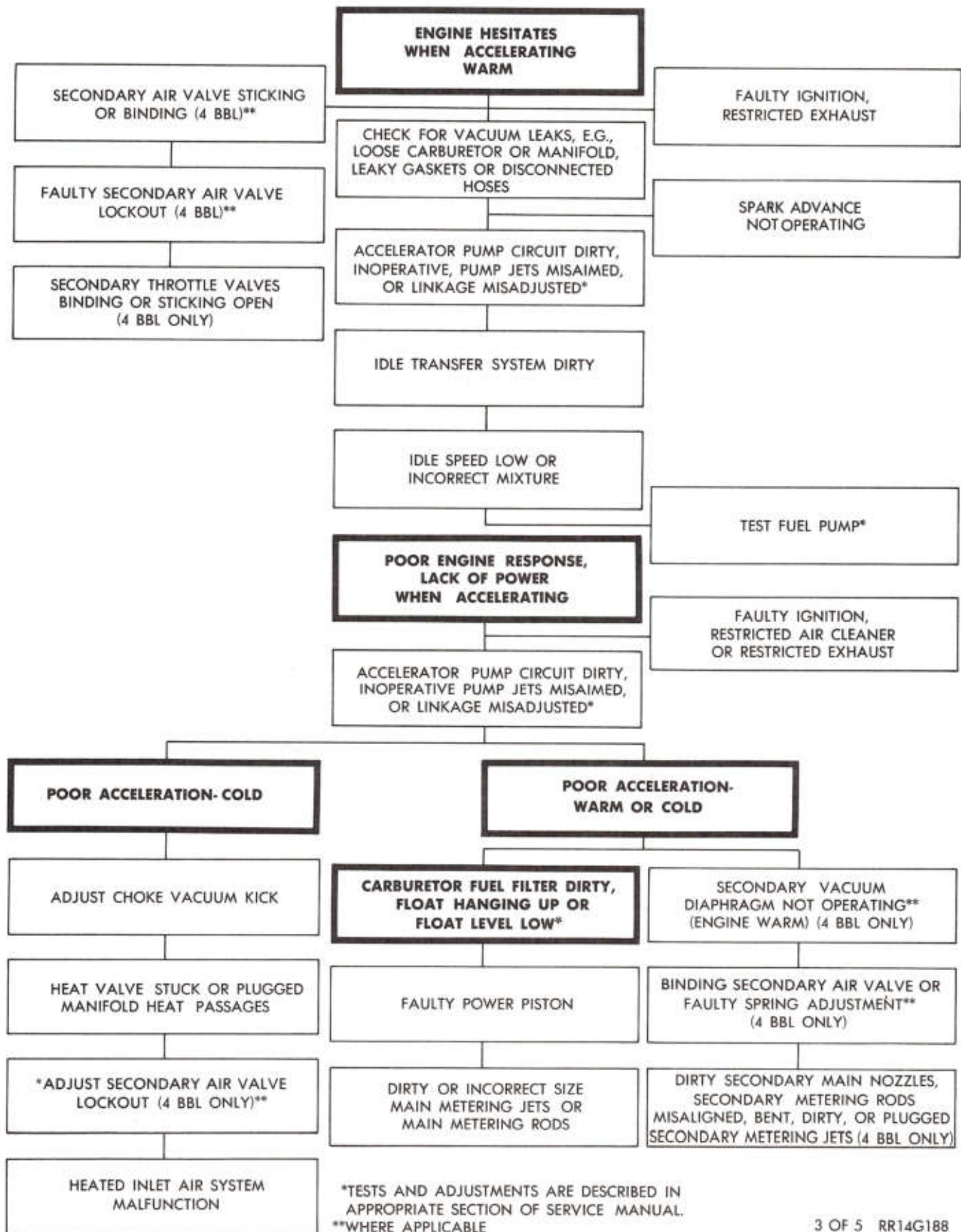


*TESTS AND ADJUSTMENTS ARE DESCRIBED IN
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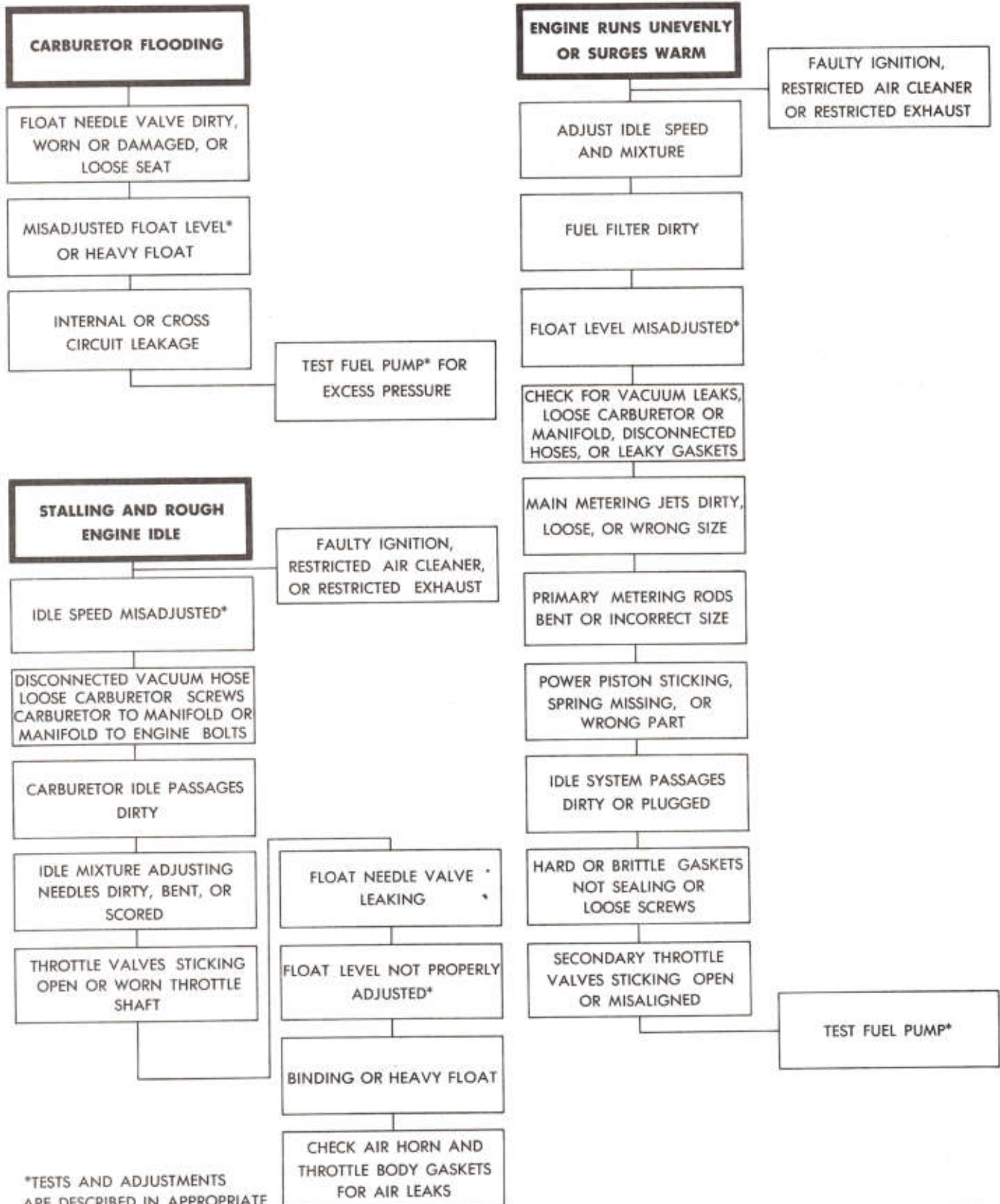
FUEL SYSTEM DIAGNOSIS PART 2



FUEL SYSTEM DIAGNOSIS PART 3

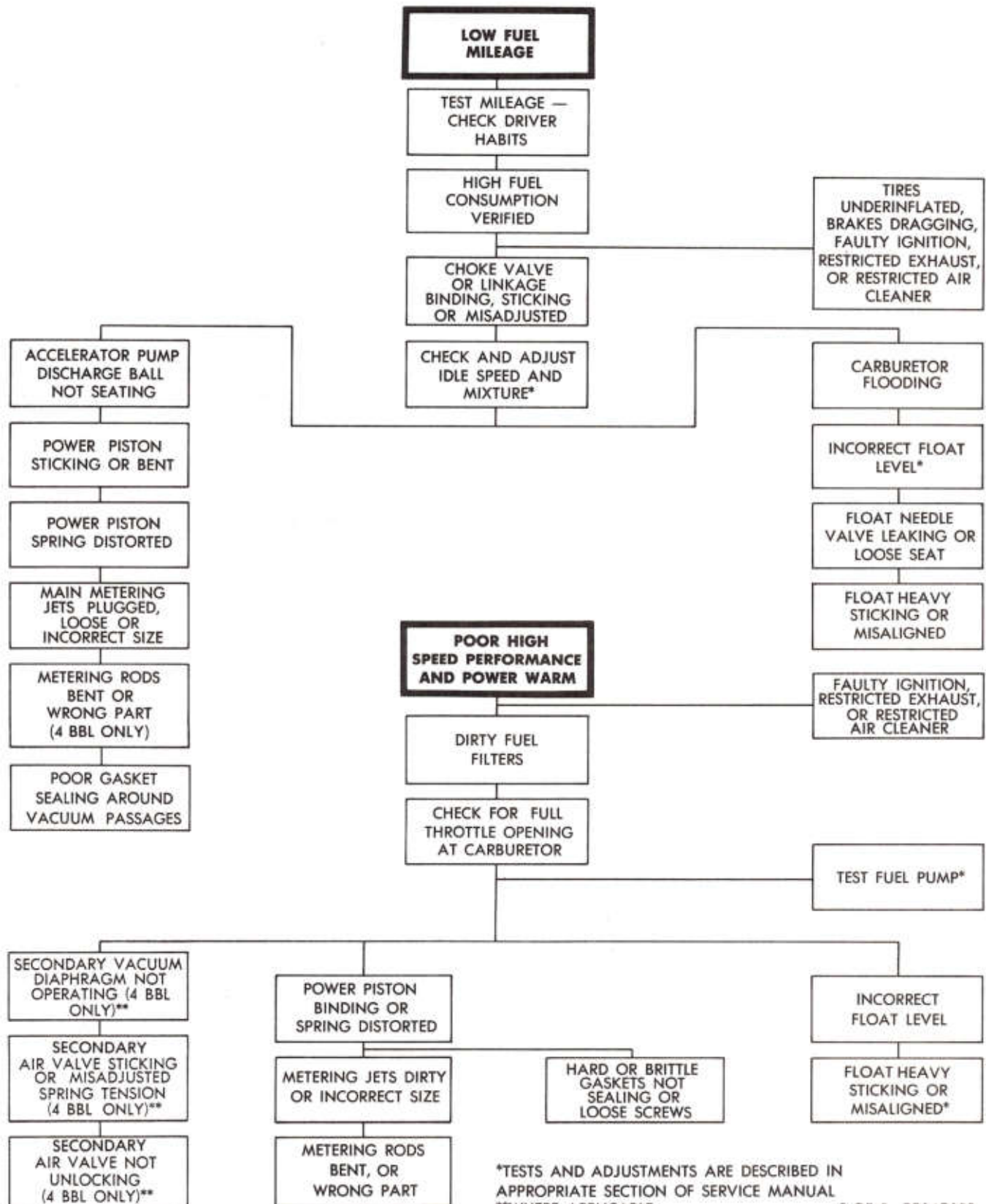


FUEL SYSTEM DIAGNOSIS PART 4



*TESTS AND ADJUSTMENTS ARE DESCRIBED IN APPROPRIATE SECTION OF SERVICE MANUAL.

FUEL SYSTEM DIAGNOSIS PART 5



*TESTS AND ADJUSTMENTS ARE DESCRIBED IN
APPROPRIATE SECTION OF SERVICE MANUAL

**WHERE APPLICABLE

SERVICING THE CARBURETOR

A thorough road test and check of minor carburetor adjustments should precede major carburetor service. Specifications for some adjustments are listed on the Vehicle Emission Control Information label found in each engine compartment.

Many performance complaints are directed at the carburetor. Some of these are a result of loose, misadjusted or malfunctioning engine or electrical components. Others develop when vacuum hoses become disconnected or are improperly routed. The proper approach to analyzing carburetor complaints should include a routine check of such areas.

(1) Inspect all vacuum hoses and actuators for leaks. Refer to the vacuum hose routing diagram label located under the hood in the engine compartment for proper hose routing.

(2) Tighten intake manifold bolts and carburetor mounting bolts to specifications.

(3) Perform cylinder compression test.

(4) Clean or replace spark plugs as necessary.

(5) Test resistance of spark plug cables. Refer to "Ignition System Secondary Circuit Inspection," Engine Electrical Section.

(6) Inspect ignition primary wire and vacuum advance operation. Test coil output voltage, primary and secondary resistance. Replace parts as necessary. Refer to "Ignition System" and make necessary adjustment.

(7) Reset ignition timing.

(8) Check carburetor idle mixture and speed adjustment. Adjust throttle stop screw to specifications.

(9) Test fuel pump for pressure and vacuum.

(10) Inspect manifold heat control valve in exhaust manifold for proper operation.

(11) Remove carburetor air filter element and blow out dirt gently with an air hose. Install a new recommended filter element if necessary.

(12) Inspect crankcase ventilation system.

(13) Road test vehicle as a final test.

Carburetor Removal

CAUTION: Do not attempt to remove the carburetor from the engine of a vehicle that has just been road tested. Allow the engine to cool sufficiently to prevent accidental fuel ignition or personal injury.

(1) Disconnect battery ground cable.

(2) Remove air cleaner.

(3) Remove fuel tank pressure vacuum filler cap. The fuel tank should be under a small pressure.

(4) Place a container under fuel inlet fitting to catch any fuel that may be trapped in fuel line.

(5) Disconnect fuel inlet line using two wrenches to avoid twisting the line.

(6) Disconnect throttle linkage, choke linkage and all vacuum hoses.

(7) Remove carburetor mounting bolts or nuts and carefully remove carburetor from engine compartment. Hold carburetor level to avoid spilling fuel from fuel bowl.

Cleaning Carburetor Parts

There are many commercial carburetor cleaning solvents available which can be used with good results.

The choke diaphragm, choke heater and some plastic parts of the carburetor can be damaged by solvents. Avoid placing these parts in **any** liquid. Clean the external surfaces of these parts with a clean cloth or a soft brush. Shake dirt or other foreign material from the stem (plunger) side of the diaphragm. Compressed air can be used to remove loose dirt **but should not be connected to the vacuum diaphragm fitting.**

If the commercial solvent or cleaner recommends the use of water as a rinse, "HOT" water will produce better results. After rinsing, all trace of water must be blown from the passages with air pressure. Never clean jets with a wire, drill, or other mechanical means, because the orifices may become damaged, causing improper performance.

When checking parts removed in the carburetor, it is recommended that new parts be installed whenever the old parts are questionable.

Carburetor Installation

Inspect the mating surfaces of carburetor and intake manifold. Be sure both surfaces are clean and free of nicks, burrs or other damage.

Place a new flange gasket on manifold surface.

Some flange gaskets can be installed upside down or backwards. To prevent this, match holes in the flange gasket to holes on bottom of carburetor, then place gasket properly on intake manifold surface.

(1) Carefully place carburetor on manifold without trapping choke rod under carburetor linkage.

(2) Install carburetor mounting bolts or nuts and tighten alternately, a little at a time, to compress flange gasket evenly. The nuts or bolts must be drawn down tightly to prevent vacuum leakage between carburetor and intake manifold.

(3) Connect throttle linkage and fuel inlet line.

(4) Check carefully for worn or loose vacuum hose connections. Refer to the vacuum hose routing diagram label located under the hood in the engine compartment.

(5) Check to be sure the choke plate opens and closes fully when operated.

(6) Check to see that full throttle travel is obtained.

(7) Install air cleaner. The air cleaner should be cleaned or replaced at this time to insure proper carburetor performance.

(8) Connect battery cable.

(9) Check carburetor idle mixture adjustment. Refer to Emission Control Label in engine compartment.

CAUTION: The practice of priming an engine by pouring gasoline into the carburetor air horn for starting after servicing the fuel system, should be strictly avoided. Cranking the engine, and then priming by depressing the accelerator pedal several times should be adequate.

Diagnosing carburetor complaints may require that

the engine be started and run with the air cleaner removed.

CAUTION: While running the engine in this mode it is possible that the engine could backfire. A backfire situation is likely to occur if the carburetor is malfunctioning, but removal of the air cleaner alone can lean the air fuel ratio in the carburetor to the point of producing an engine backfire.

The battery cable should be removed from the negative terminal of the battery before any fuel system component is removed. This precaution will prevent the possibility of ignition of fuel during servicing.

ROCHESTER QUADRAJET CARBURETOR

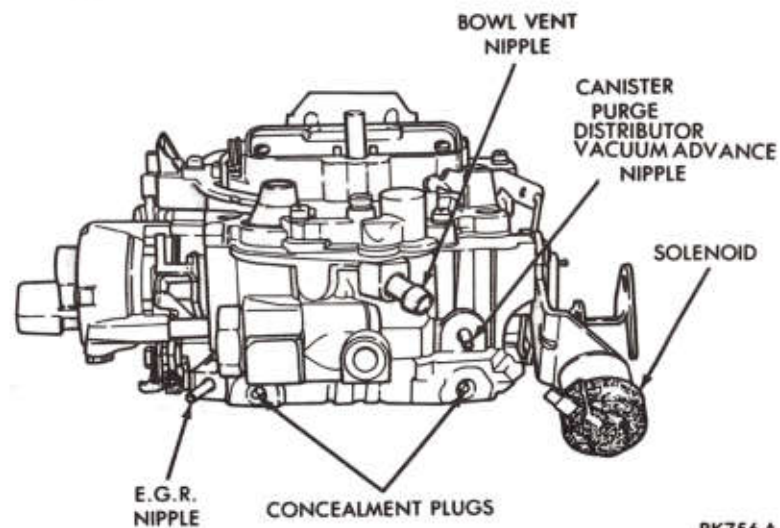
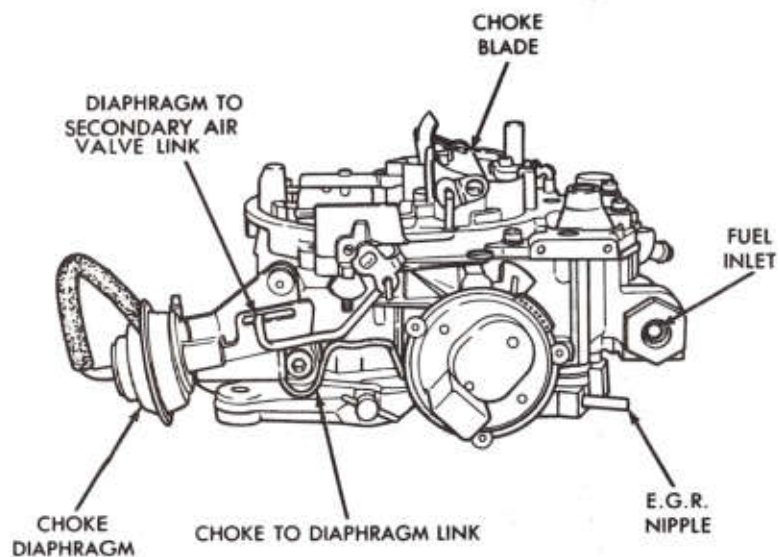
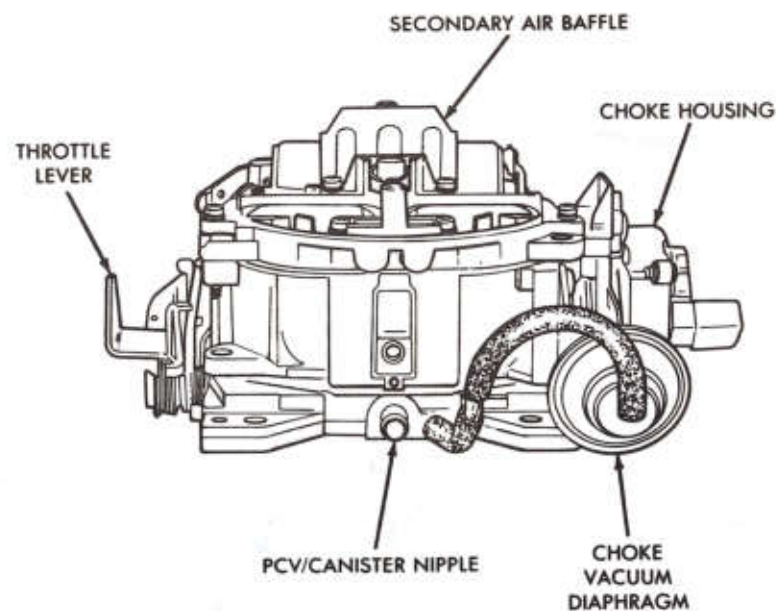
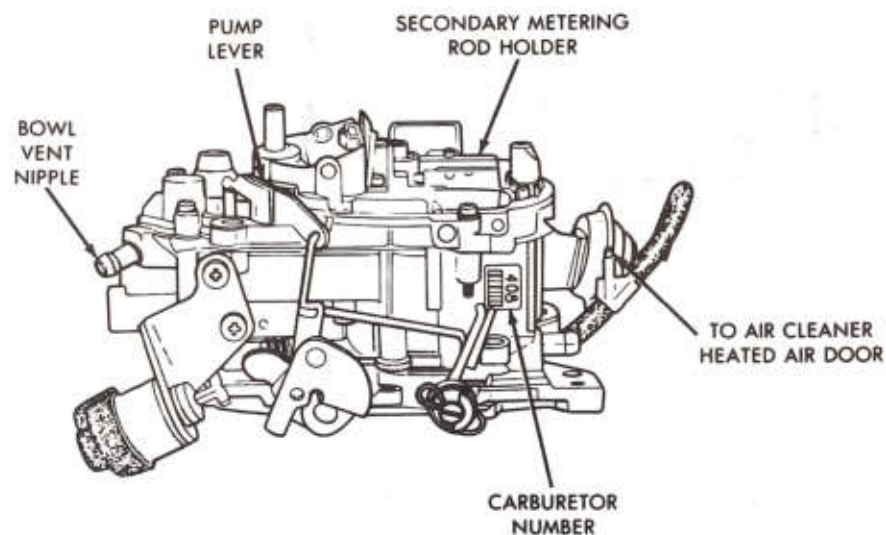
INDEX

	Page		Page
Service Procedures	64	Air Valve Spring Adjustment	72
Air Horn Disassembly	65	Choke Coil Lever Adjustment	72
Air Horn Installation	70	Choke Rod Fast Idle Cam Adjustment	
Air Horn Removal	64	Angle Gauge Method	73
Concealment Plug Removal	68, 79	Plug Gauge Method	74
Choke Cover Installation	67	Choke Vacuum Kick Adjustment	
Choke Cover Removal	67	Angle Gauge Method	74
Choke Removal	68	Plug Gauge Method	75
Cleaning and Inspection	68	Choke Unloader Adjustment	
Float Bowl Assembly	69	Angle Gauge Method	76
Float Bowl Disassembly	65	Plug Gauge Method	76
Throttle Body Disassembly	68	Fast Idle Speed Adjustment	78
Accelerator Pump System	62	Float Adjustment	71
Choke System	62	Float Level External Check	71
Float System	60	Idle RPM Adjustment	78
General Information	56	Propane Assisted Idle Set Procedure	80
Idle System	60	Secondary Lockout Adjustment	77
Main Metering System	60	Solenoid Idle RPM Adjustment	77
Power System	62	Specifications	81
Carburetor Adjustment Procedures	71	Using Choke Valve Angle Gauge	73
Air Valve Rod Adjustment	75		

GENERAL INFORMATION

The Rochester Quadrajet (Figs. 1, 2 and 3) is a four-barrel two-stage carburetor, there are three main carburetor assemblies; the air horn, float bowl, and throttle body. There are six basic operating systems:

1. Float system
2. Idle system
3. Main metering system
4. Power system
5. Pump system
6. Choke system



RK756 A

Fig. 1—Rochester Carburetor



Fig. 2—Rochester Carburetor (Exploded View)

- | | | |
|--|---|---|
| 1 GASKET - AIR CLEANER | 240 SEAT - FLOAT NEEDLE | 345 SCREW - CHOKE STAT LEVER ATTACHING |
| 5 GASKET - FLANGE | 241 GASKET - FLOAT NEEDLE SEAT | 348 LEVER - CHOKE STAT |
| 10 AIR HORN ASSEMBLY | 248 JET - PRIMARY METERING | 350 INTERMEDIATE CHOKE SHAFT, LEVER AND LINK ASSEMBLY |
| 30 SCREW - SECONDARY METERING ROD HOLDER ATTACHING | 250 PLUG - PUMP DISCHARGE (RETAINER) | 352 FAST IDLE CAM ASSEMBLY |
| 31 HOLDER - SECONDARY METERING ROD | 251 BALL - PUMP DISCHARGE | 354 LEVER - INTERMEDIATE CHOKE |
| 32 ROD - SECONDARY METERING | 252 BAFFLE - PUMP WELL | 356 LINK - CHOKE |
| 35 LEVER - CHOKE | 310 HOSE - THROTTLE BODY TO "T" | 360 LEVER - SECONDARY THROTTLE LOCKOUT |
| 36 SCREW - CHOKE LEVER ATTACHING | 311 "T" - VACUUM HOSE - SECONDARY SIDE VACUUM BREAK (CHOKE DIAPHRAGM) | 364 SEAL - INTERMEDIATE CHOKE SHAFT |
| 41 LEVER - PUMP | 312 HOSE - "T" TO SECONDARY SIDE VACUUM BREAK (CHOKE DIAPHRAGM) | 370 NUT - FUEL INLET |
| 42 PIN - PUMP LEVER HINGE | 320 VACUUM BREAK ASSEMBLY (CHOKE DIAPHRAGM)-SECONDARY SIDE - REAR | 372 GASKET - FUEL INLET NUT |
| 45 SCREW ASSEMBLY - AIR HORN TO THROTTLE BODY | 321 SCREW - SECONDARY SIDE (REAR) VACUUM BREAK ASSEMBLY (CHOKE DIAPHRAGM) ATTACHING | 375 FILTER - FUEL INLET |
| 46 SCREW ASSEMBLY - AIR HORN TO FLOAT BOWL | 322 LINK - SECONDARY SIDE (REAR) VACUUM BREAK (CHOKE DIAPHRAGM) TO CHOKE | 377 SPRING - FUEL FILTER |
| 47 SCREW - AIR HORN TO FLOAT BOWL (COUNTERSUNK) | 323 LINK - SECONDARY SIDE VACUUM BREAK (CHOKE DIAPHRAGM)-AIR VALVE LEVER | 380 SCREW - THROTTLE STOP |
| 50 BAFFLE - AIR HORN | 330 RIVET - CHOKE COVER ATTACHING | 381 SPRING - THROTTLE STOP SCREW |
| 67 RETAINER - PUMP STEM SEAL | 331 RETAINER - CHOKE COVER | 400 THROTTLE BODY ASSEMBLY |
| 68 SEAL - PUMP STEM | 335 ELECTRIC CHOKE COVER AND STAT ASSEMBLY | 401 GASKET - FLOAT BOWL TO THROTTLE BODY |
| 201 GASKET - AIR HORN TO FLOAT BOWL | 340 CHOKE HOUSING ASSEMBLY | 405 SCREW ASSEMBLY - FLOAT BOWL TO THROTTLE BODY |
| 205 PUMP ASSEMBLY | 341 SCREW AND WASHER ASSEMBLY - CHOKE HOUSING TO FLOAT BOWL | 410 LINK - PUMP |
| 206 SPRING - PUMP RETURN | | 420 NEEDLE - IDLE MIXTURE |
| 212 POWER VALVE PISTON ASSEMBLY | | 421 SPRING - IDLE MIXTURE NEEDLE |
| 213 ROD - PRIMARY METERING | | 422 PLUG - IDLE MIXTURE NEEDLE |
| 214 SPRING - PRIMARY METERING ROD (M2M, M4M ONLY) | | 425 SCREW - FAST IDLE ADJUSTING |
| 218 SPRING - POWER PISTON | | 426 SPRING - FAST IDLE ADJUSTING SCREW |
| 235 INSERT - FLOAT BOWL | | 430 HOSE |
| 236 HINGE PIN - FLOAT | | 500 SOLENOID AND BRACKET ASSEMBLY |
| 237 FLOAT | | 501 SCREW - BRACKET ATTACHING |
| 238 PULL CLIP - FLOAT NEEDLE | | |
| 239 NEEDLE - FLOAT | | |

Fig. 3—Exploded View Parts Description

Float System (Fig. 4)

The purpose of the float system is to maintain an adequate supply of fuel in the fuel bowl for use by the various fuel delivery systems.

A single float chamber supplies fuel to all carburetor bores. A closed cell rubber float, brass needle seat and plastic tipped float needle with pull clip, are used to control fuel level in the float chamber.

Idle System (Fig. 5)

Each bore of the carburetor has a separate and independent idle system to provide the correct air/fuel

mixture to the engine during idle and off-idle operations. The idle system is required since air flow through the carburetor venturi is not sufficient to obtain efficient metering from the main discharge nozzles.

Main Metering System (Fig. 6)

The main metering system supplies fuel to the engine from off-idle to wide open throttle. The system air and fuel during this range through plain tube nozzles and the venturi principal. The multiple venturi in each bore produces excellent fuel metering control due to its sensitivity to air flow.

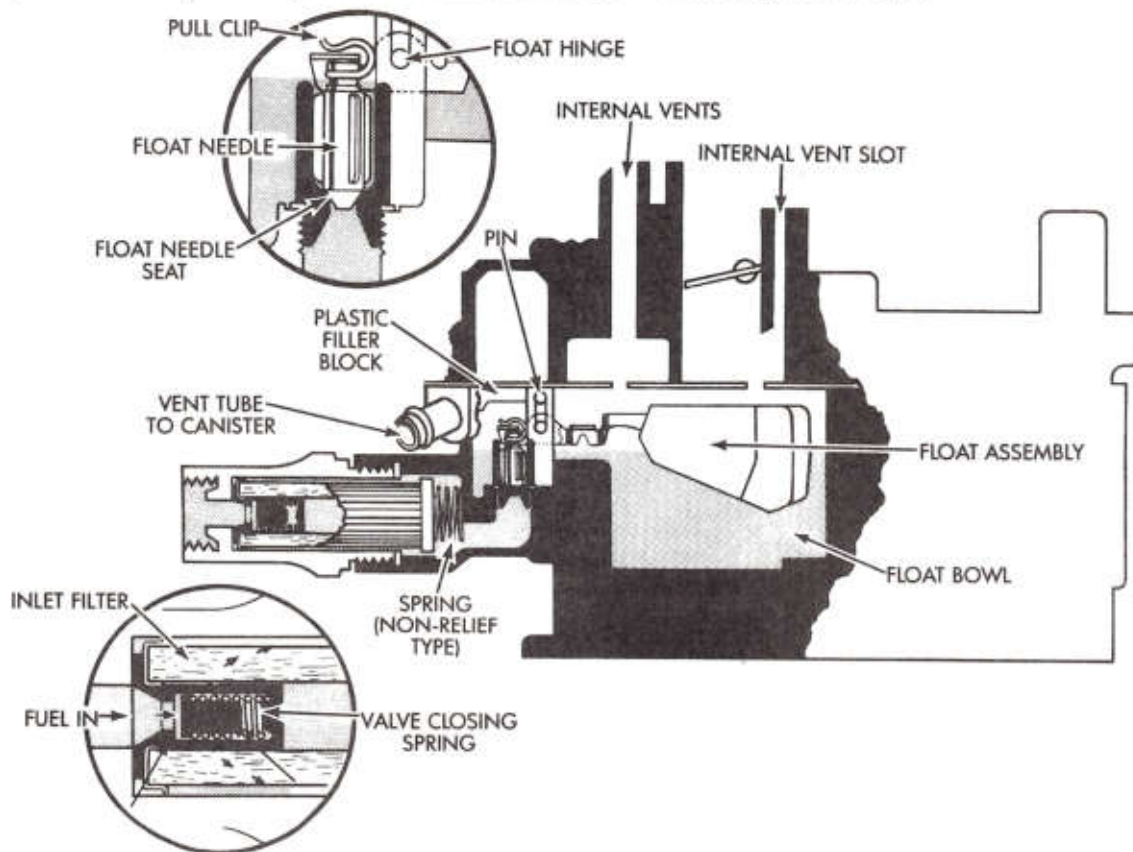
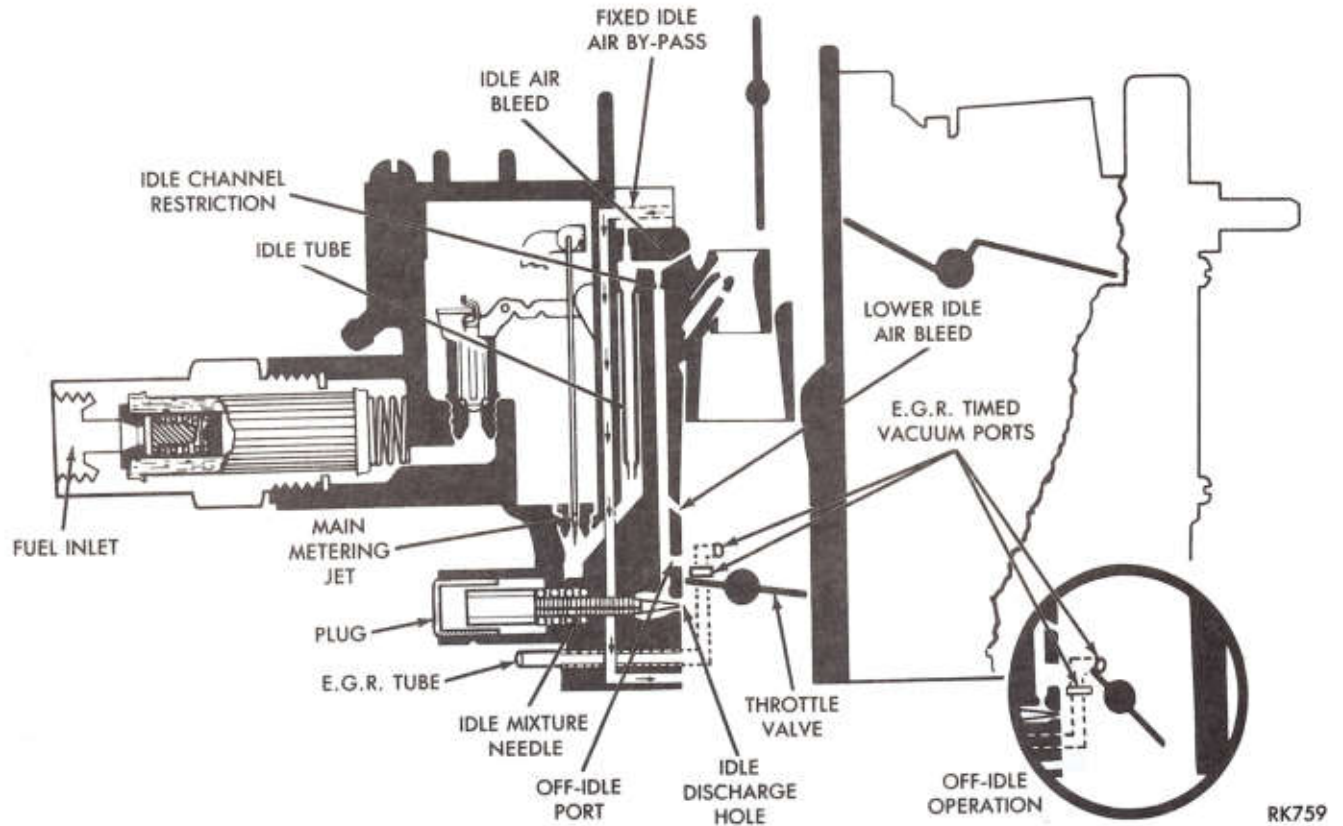
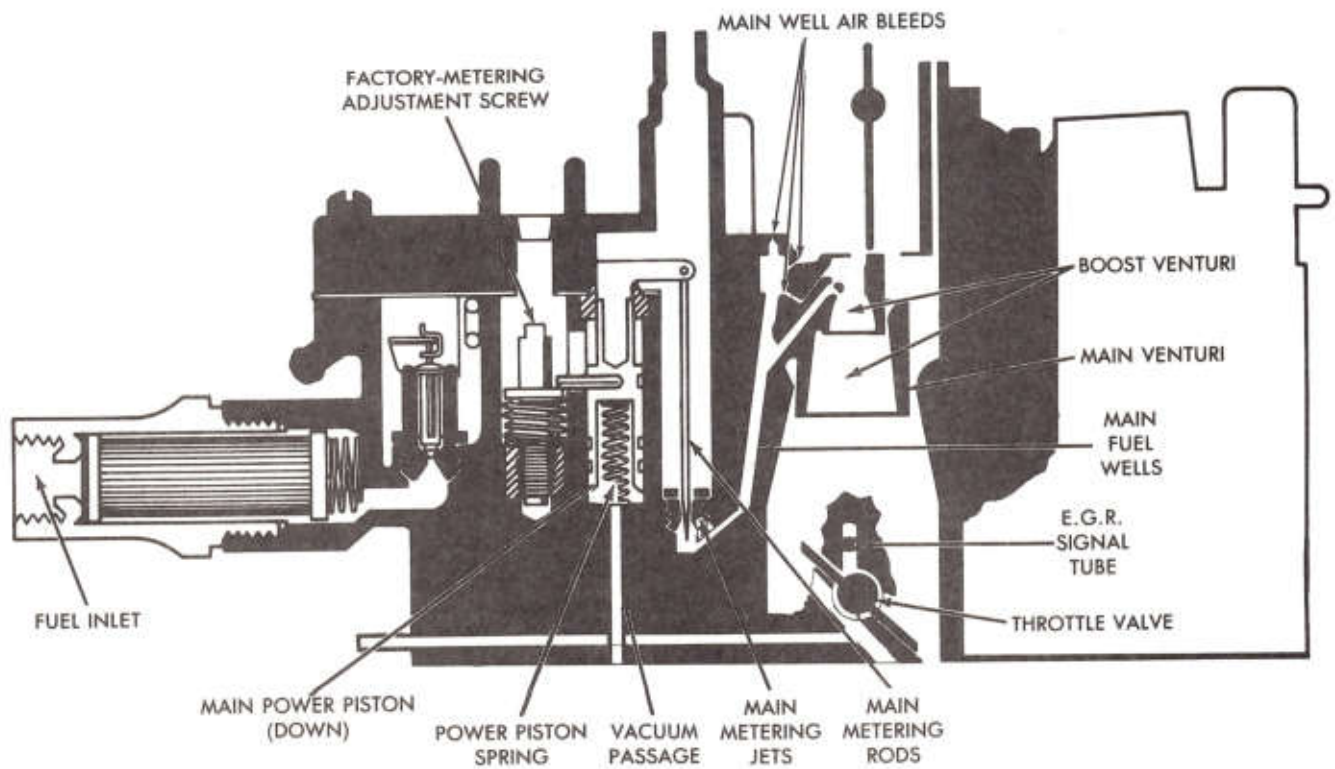


Fig. 4—Float System



RK759

Fig. 5—Idle System



RK760

Fig. 6—Main Metering System

Power System (Fig. 7)

The power system provides extra mixture enrichment to meet power requirements under heavy engine loads and high speed operation. The richer mixtures are supplied through the main metering systems in the primary and secondary sides of the carburetor.

Accelerator Pump System (Fig. 8)

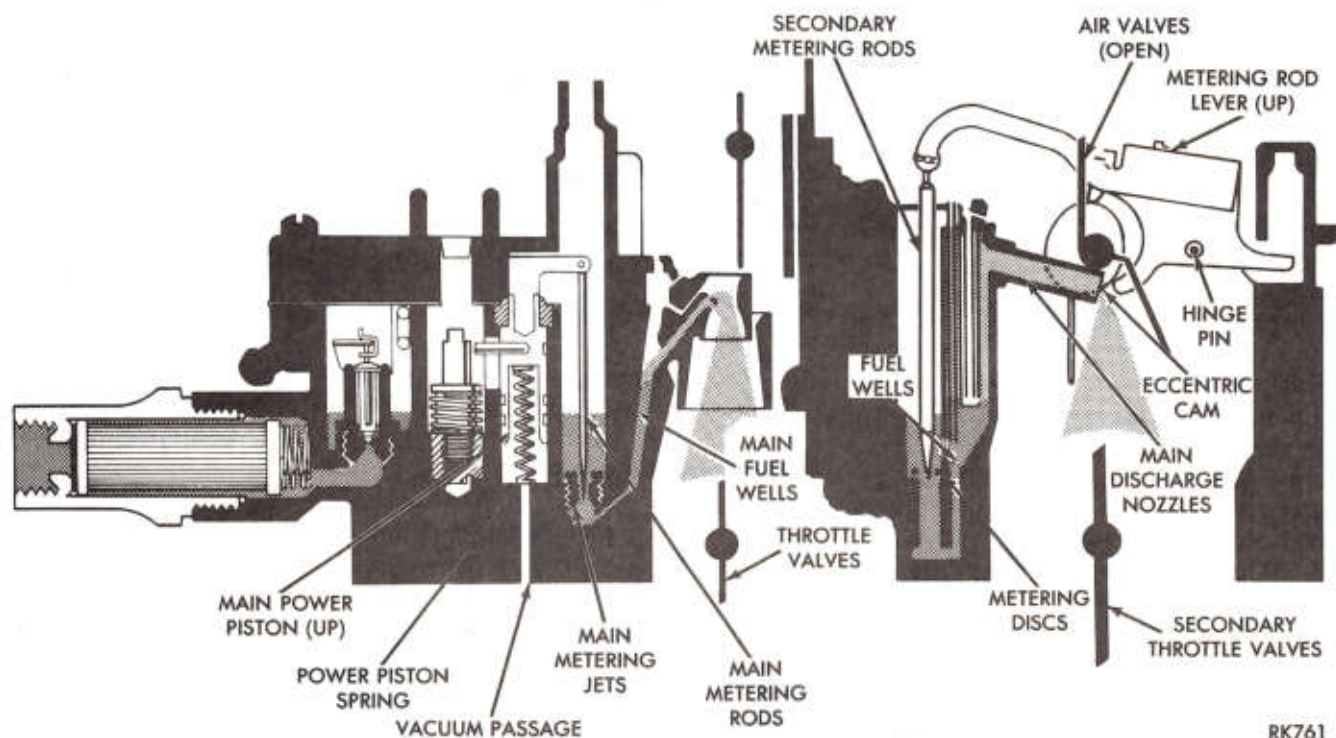
During quick accelerations when the throttle is opened rapidly, air flow through the carburetor bores and intake manifold changes almost instantly. However, the fuel, which is heavier tends to lag behind causing a momentary leanness. To prevent this the

accelerator pump system is used to provide extra fuel necessary for smooth acceleration.

Choke System (Fig. 9)

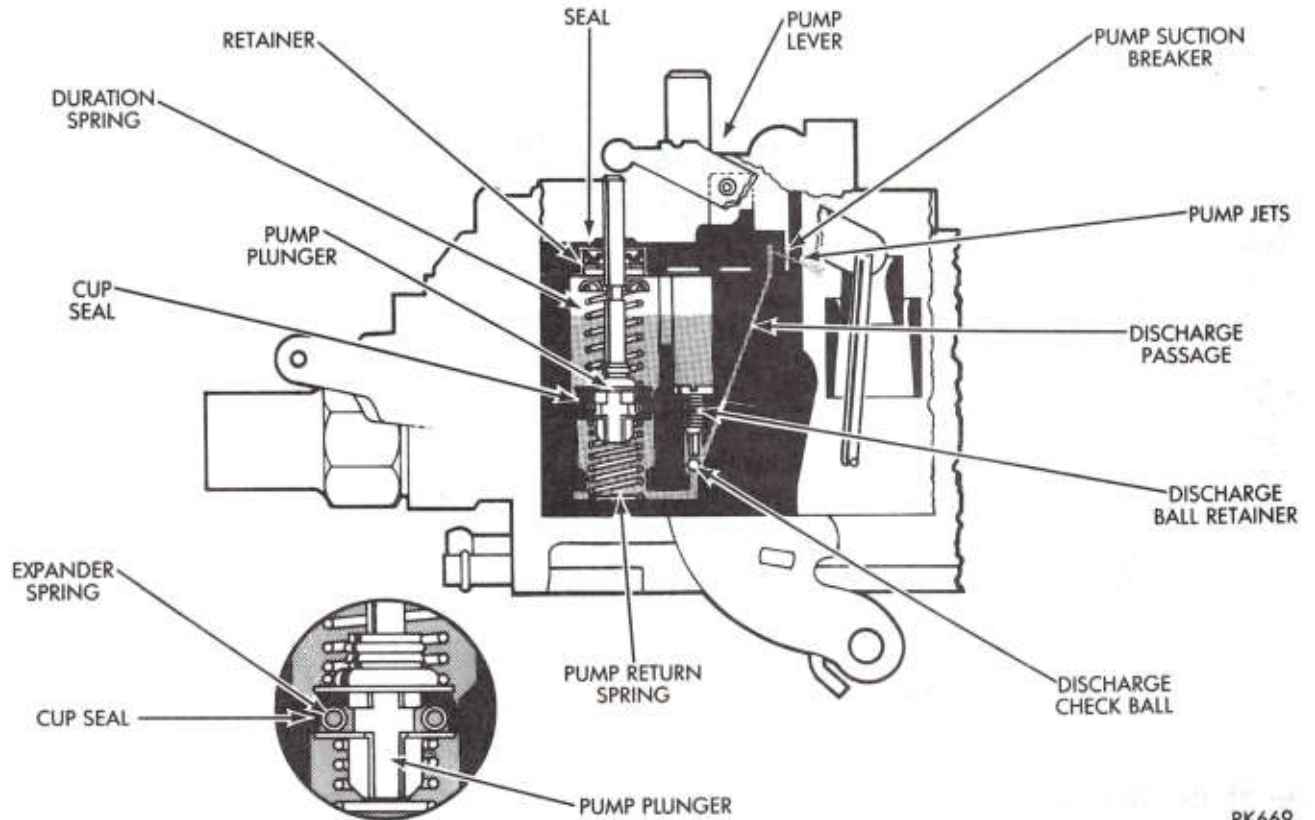
The off-set choke valve is mounted in the air horn above the primary carburetor venturi. The closed choke valve provides the correct air/fuel mixture enrichment for cold engine starting. The choke valve also assists engine running during the warm up period.

An electric choke coil is mounted in the choke housing. This system uses electric current supplied to the choke coil which combined with the off-set choke valve and throttle position, control choke operation.



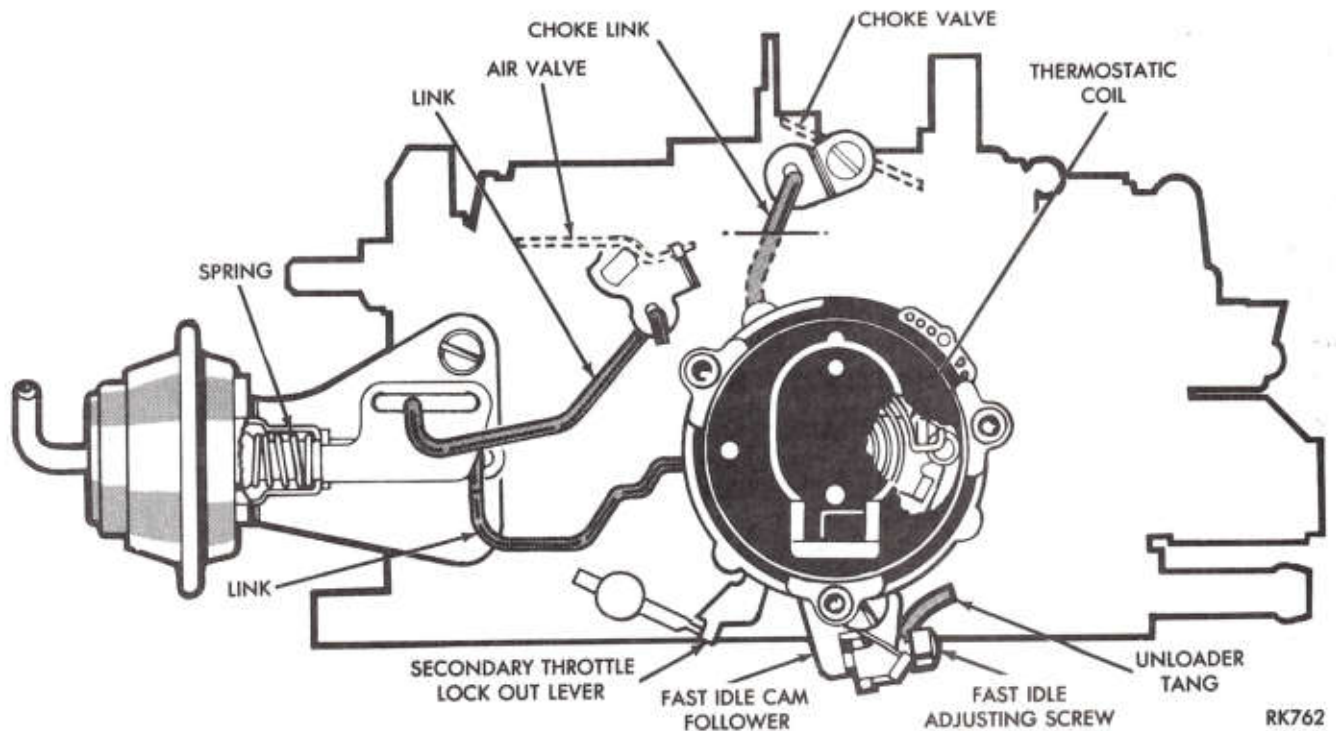
RK761

Fig. 7—Power System



RK669

Fig. 8—Typical Accelerator Pump System



RK762

Fig. 9—Choke System

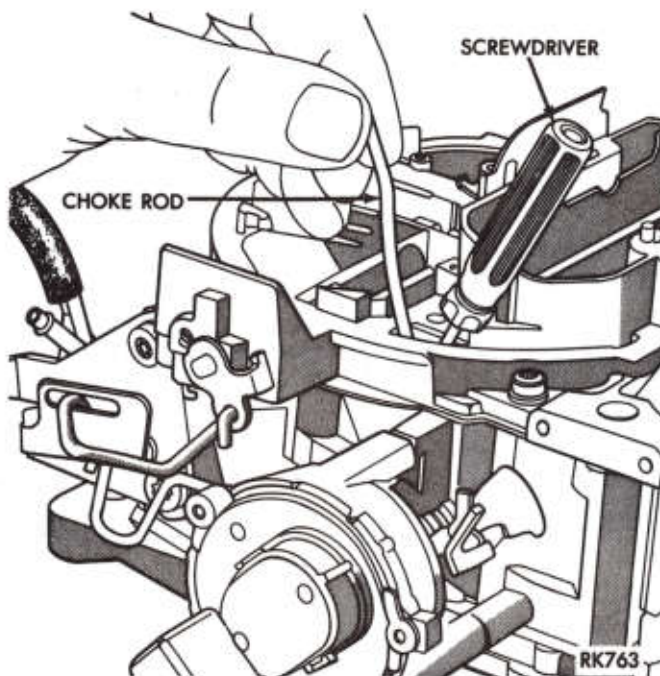


Fig. 10—Removing Choke Rod

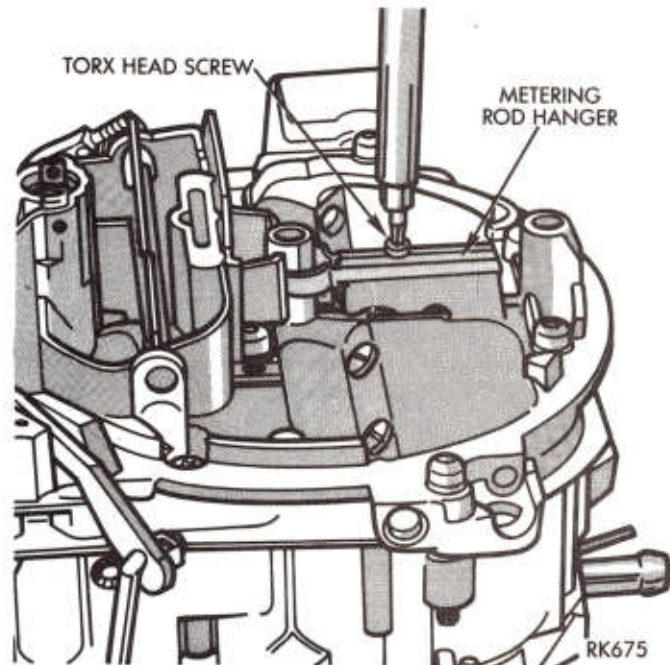


Fig. 11—Servicing Metering Rod Hanger

SERVICE PROCEDURES

AIR HORN REMOVAL

(1) Remove upper choke lever retaining screw and remove choke lever.

(2) Remove choke rod lower lever inside float bowl casting. Remove rod by holding lever outward with a small screwdriver and twisting rod counterclockwise (Fig. 10).

(3) Remove small screw (#8 torx head) from metering rod hanger and remove hanger and metering rods (Fig. 11).

(4) Using a small drift punch and a hammer, drive roll pin inward until pump lever can be removed (Fig. 12).

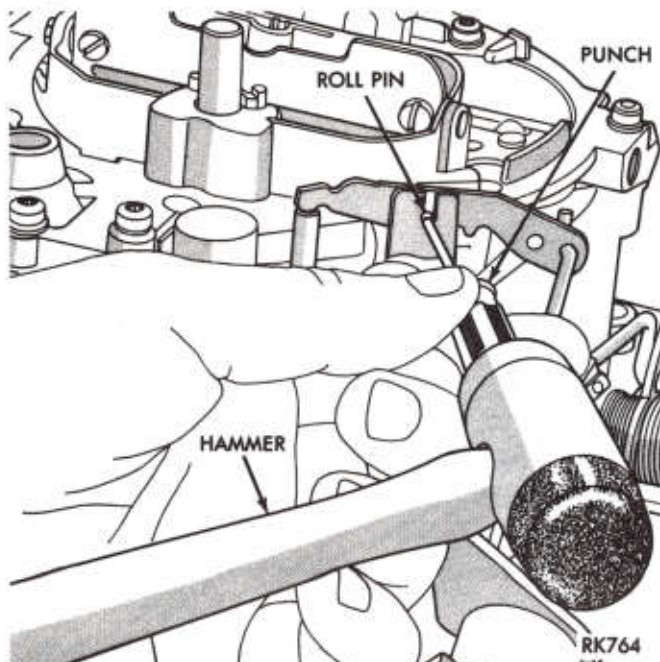


Fig. 12—Removing Roll Pin

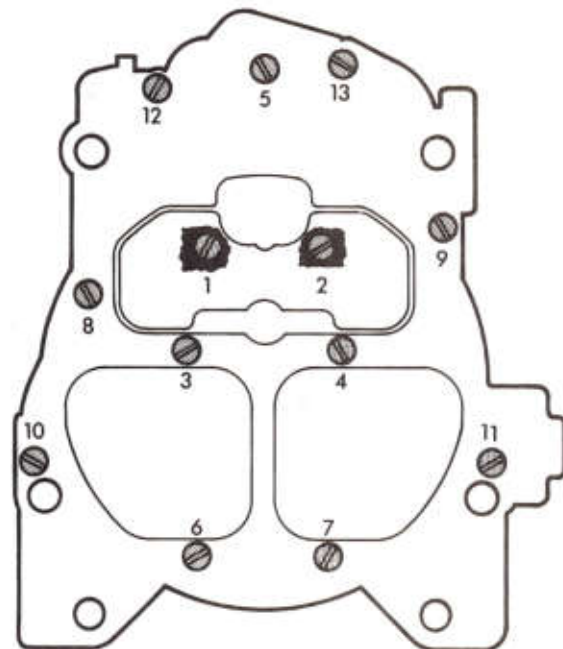


Fig. 13—Air Horn Screw Locations

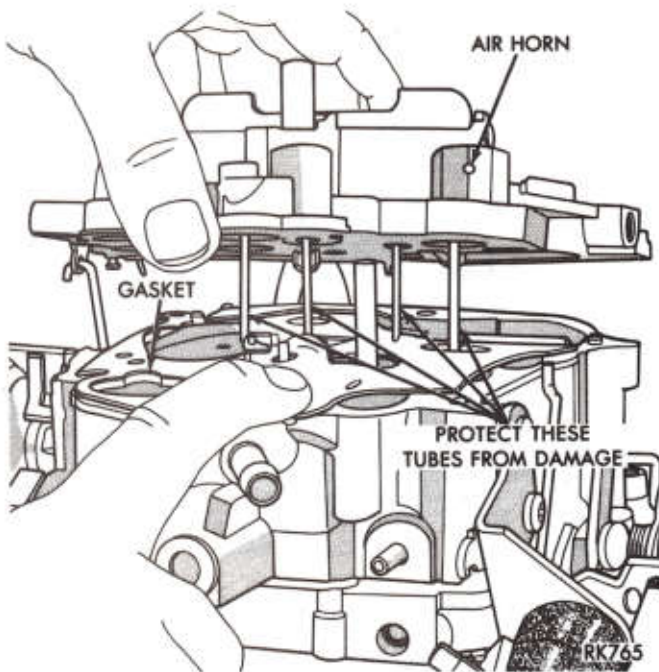


Fig. 14—Removing Air Horn

- (5) Remove choke vacuum hose from tube on throttle body.
- (6) Remove air horn mounting screws and secondary air baffle deflector (Fig. 13).
- (7) Remove air horn from float bowl by lifting it straight up. The air horn gasket should remain on the float bowl. Use care not to damage the small tubes attached to the air horn. These tubes are permanently attached to the air horn (Fig. 14).

AIR HORN DISASSEMBLY

- (1) If air horn is to be soaked in carburetor cleaner the accelerator pump plunger stem seal must be removed.
- (2) Invert air horn and use a small screwdriver to

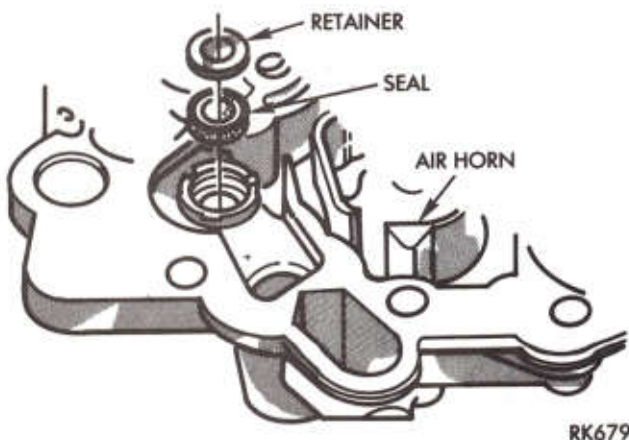


Fig. 15—Accelerator Pump Plunger and Seal

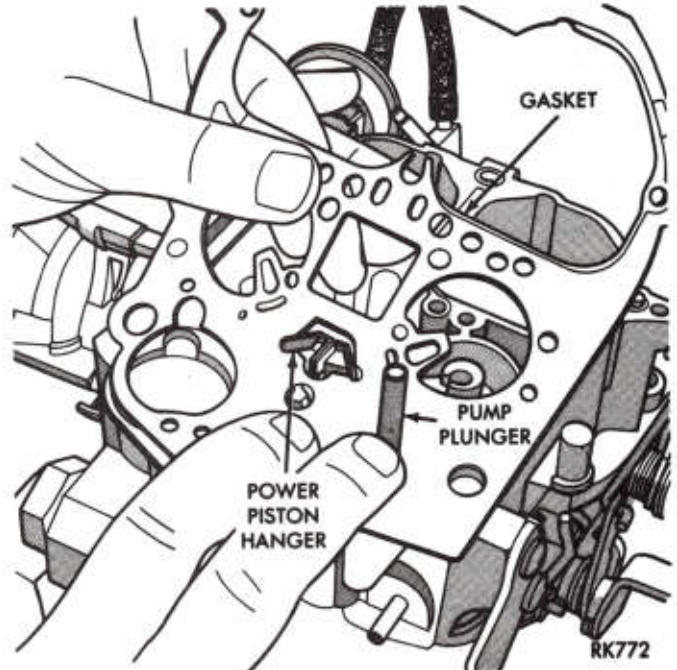


Fig. 16—Removing Air Horn Gasket

remove staking holding seal retainer in place. Remove and discard retainer and seal (Fig. 15).

FLOAT BOWL DISASSEMBLY

- (1) Remove air horn gasket by lifting it off locating pins and lifting tab of gasket from under the power piston hanger. Use care not to damage the metering rods or springs. Remove and discard gasket (Fig. 16).

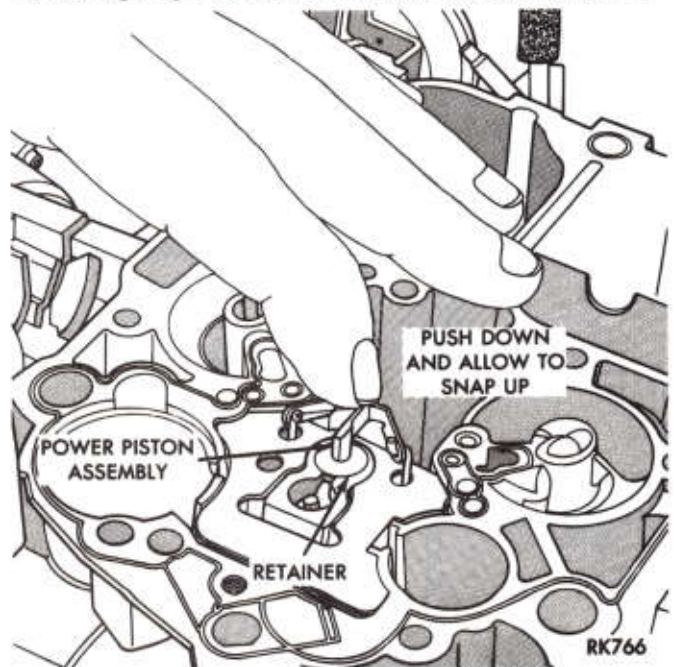


Fig. 17—Removing Power Piston

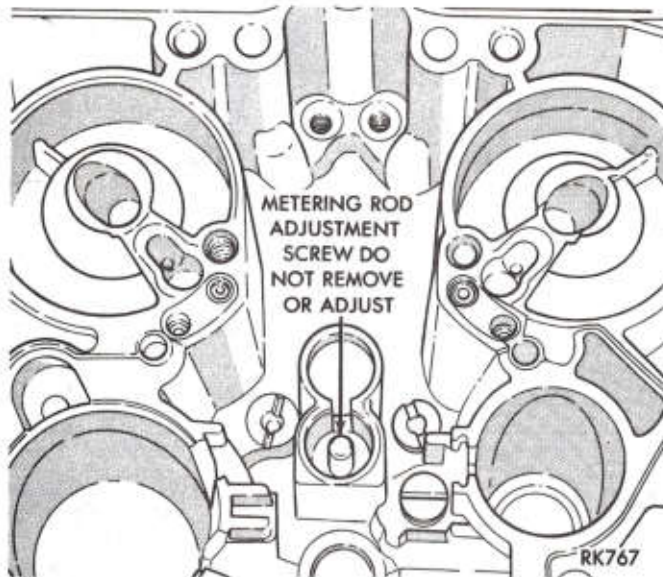


Fig. 18—Metering Rod Adjusting Screw

(2) Remove pump plunger and plunger spring from well.

(3) Remove power piston assembly by depressing piston stem and allowing it to snap up (Fig. 17). This procedure may have to be repeated several times to free piston retainer. Do not use pliers on the metering rod hanger to remove the power piston. This will cause the hanger to separate from the piston.

(4) Remove power piston spring from well.

(5) **Do not remove metering rod adjustment screw (Fig. 18). This screw is set at the factory and no**

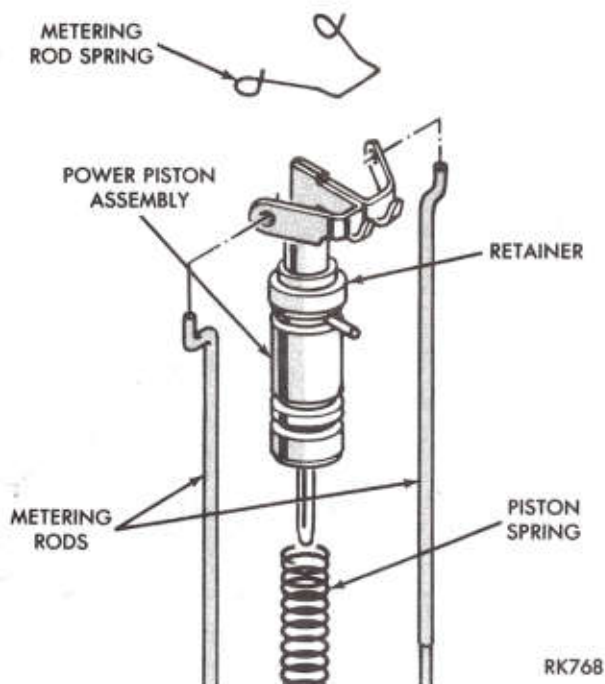


Fig. 19—Power Piston Assembly

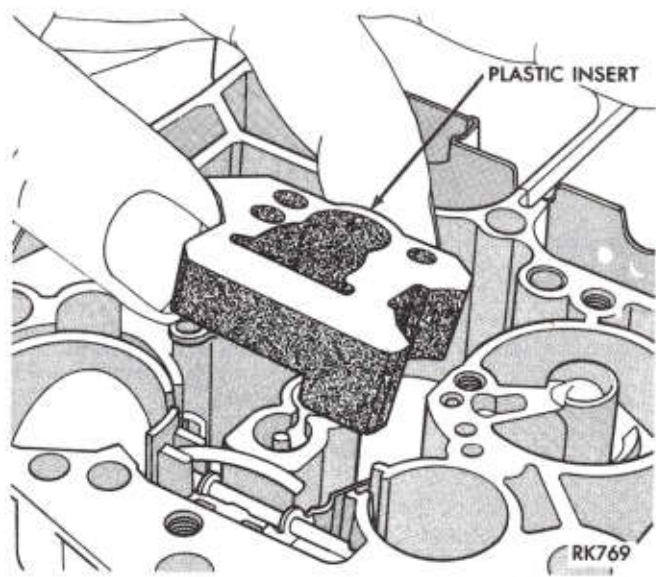


Fig. 20—Removing Plastic Filler Block

attempt should be made to change the adjustment.

(6) Separate metering rods from power piston by disconnecting tension spring from top of each rod (Fig. 19). Note the position of the tension spring for reinstallation.

(7) Remove plastic filler block float bowl (Fig. 20).

(8) Remove float assembly by pulling up on retaining pin (Fig. 21).

(9) If necessary, remove primary main metering jets (Fig. 22). Do not remove secondary metering jets. These jets are a permanent part of the float bowl.

(10) Remove pump discharge check ball retainer (Fig. 22). Invert bowl and catch check ball as it falls from the bowl.

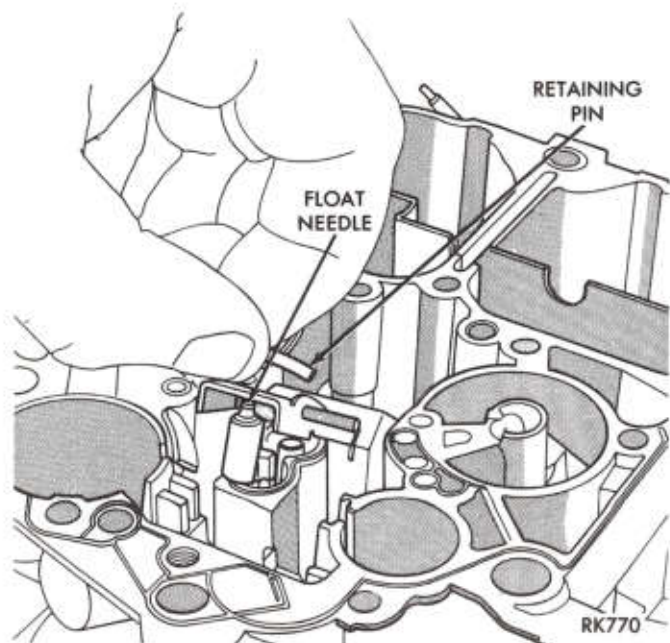


Fig. 21—Removing Float

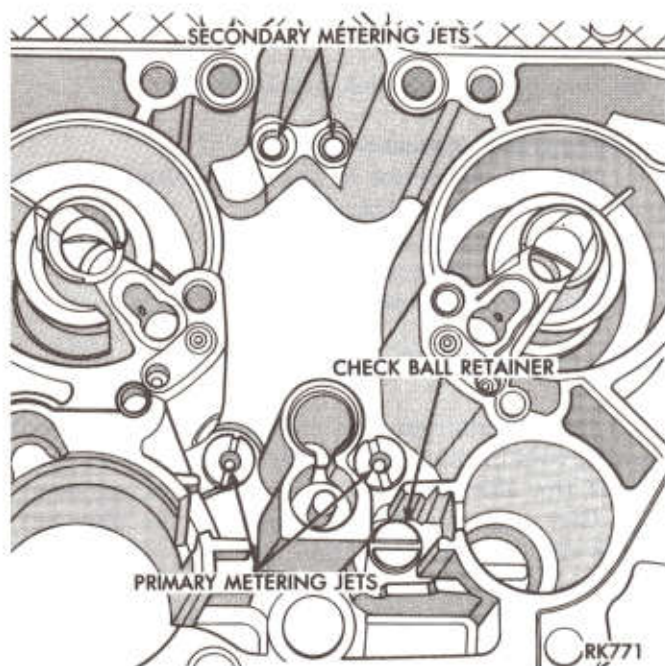


Fig. 22—Primary and Secondary Jets

(11) Remove secondary air baffle if replacement is required.

(12) Remove pump well fill slot only if necessary.

(13) Remove vacuum diaphragm hose, remove mounting screws, and rotate diaphragm assembly to remove the vacuum kick link from the slot in the plunger head.

(14) Remove fuel inlet nut, gasket, filter assembly and spring (Fig. 23). Discard filter assembly and gasket.

(15) Remove three throttle body to float bowl attaching screws and remove throttle body assembly (Fig. 24).

(16) Remove and discard throttle body to bowl gasket.

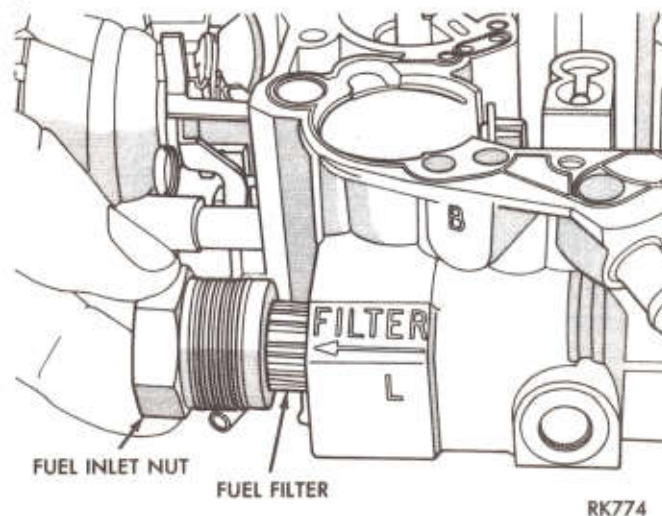


Fig. 23—Removing Fuel Inlet Nut

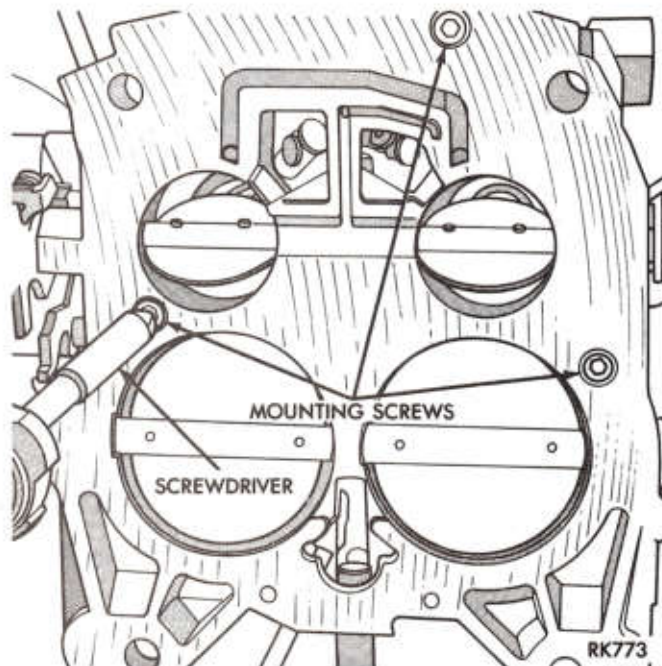


Fig. 24—Removing Throttle Body

CHOKE COVER REMOVAL

(1) Support carburetor in holding fixture C-3886 to avoid throttle plate damage.

(2) Drill out three choke cover retaining rivets using a number 21 (.159") drill. Only drill enough to remove rivet heads (Fig. 25).

(3) Remove choke cover by pulling it straight out.

(4) Drive out remainder of rivets from choke housing using a suitable punch and small hammer.

CHOKE COVER INSTALLATION

(1) Place cam follower on highest step of fast idle cam.

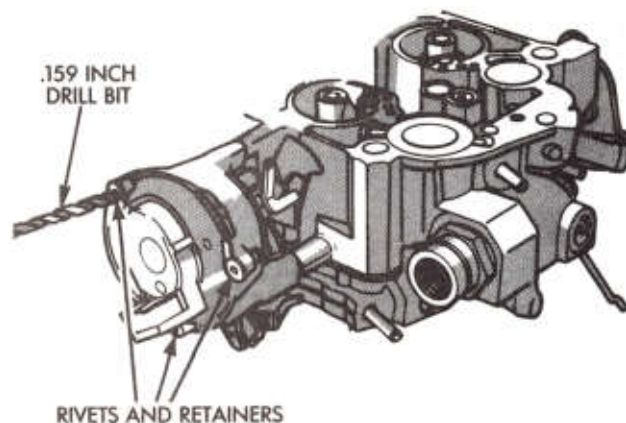


Fig. 25—Removing Choke Cover Rivets

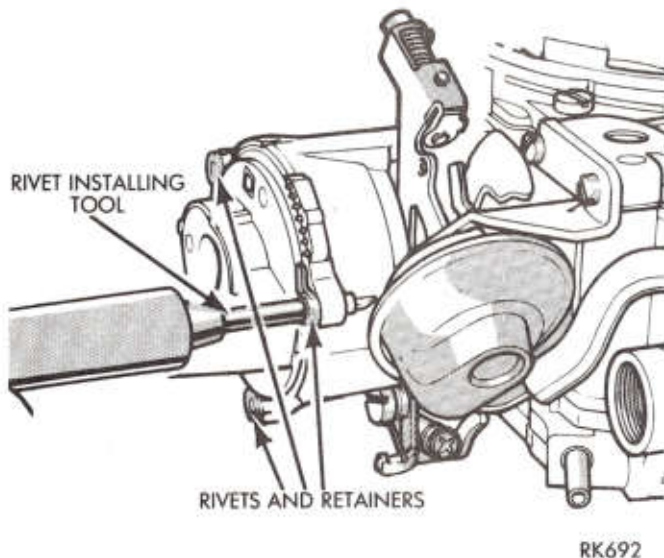


Fig. 26—Installing Choke Cover Rivets

(2) Install thermostatic cover and coil assembly in the choke housing making sure coil tang engages the inside coil pick-up lever.

(3) Reinstall choke cover retainers and blind rivets using a suitable blind rivet tool (Fig. 26).

CHOKE REMOVAL

(1) Remove choke cover.

(2) Remove choke mounting screw from inside choke housing and slide choke assembly out of float bowl (Fig. 27).

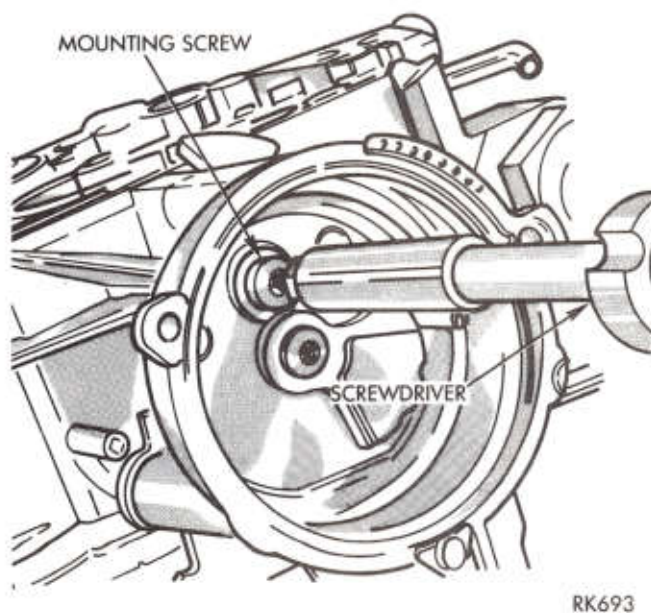


Fig. 27—Removing Choke

(3) Remove secondary throttle valve lock out lever from float bowl.

(4) Remove vacuum kick link from lever.

Throttle Body Disassembly

(1) Support carburetor in holding fixture C-3886 to avoid throttle plate damage.

(2) Remove pump rod from throttle lever by rotating rod until tang on rod aligns with lever.

(3) Remove concealment plugs.

CONCEALMENT PLUG REMOVAL (Fig. 28)

(1) Invert carburetor and use hacksaw to make two parallel cuts in the throttle body. Make cuts on each side of the locator points beneath the concealment plug. The cuts should reach down to the plug but should not extend more than 1/8 inch beyond the locator points. The distance between the saw cuts will depend on the size of the punch to be used.

(2) Place a flat punch at a point near the ends of the saw marks in the throttle body. Hold the punch at a 45° angle and drive it into the throttle body until the casting breaks away, exposing the steel plug.

(3) Repeat the procedure for the other concealment plug.

(4) Use Tool C-4895 (BT-7610B) to remove idle mixture screws.

CLEANING AND INSPECTION

Metal carburetor parts should be cleaned in a cold

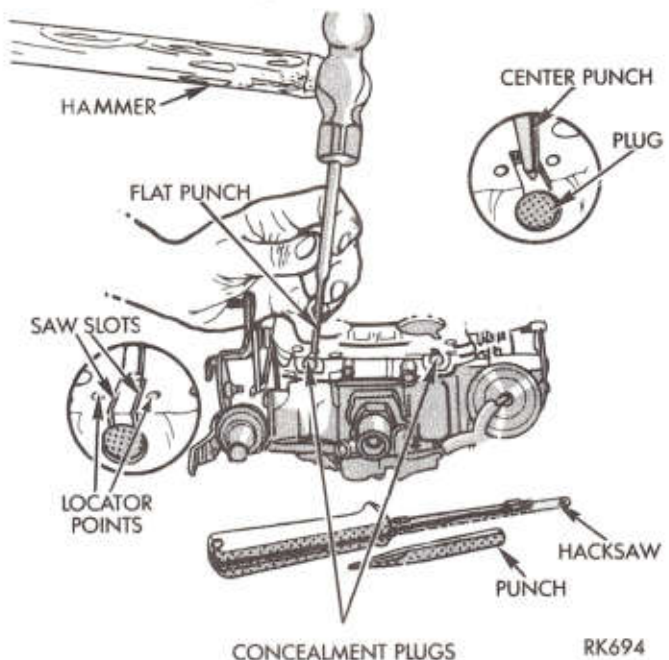


Fig. 28—Concealment Plug Removal

immersion type cleaner such as carbon X (X-55) or its equivalent.

The electric solenoid, rubber parts, plastic parts, diaphragm, pump plunger, pump stem seal, etc., should not be put in an immersion-type cleaner as they will swell, harden or distort. The plastic cam on the air valve shaft and the bushing in the fuel bowl will withstand normal cleaning. Rinse thoroughly after cleaning.

(1) Thoroughly clean all metal parts and blow dry with shop air. Make sure all passages and metering parts are free of burrs and dirt. Do not pass drills or wire through jets.

(2) Inspect upper and lower surfaces of carburetor castings for damage.

(3) Inspect holes in levers for excessive wear or out-of-round conditions. If worn, levers should be replaced.

(4) Inspect plastic parts for cracks, damage, etc. Replace, if necessary.

FLOAT BOWL ASSEMBLY

(1) Install new float bowl to throttle body gasket over locating dowels on bottom of float bowl.

(2) Install throttle body over dowels on float bowl. Install three throttle body mounting screws and tighten securely (Fig. 24).

(3) Support carburetor with holding fixture C-3886 to avoid throttle plate damage.

(4) Install fuel inlet filter spring, a new filter assem-

bly, new gasket and inlet nut. Tighten nut to 24 N·m (18 foot-pounds) (Fig. 23).

(5) Install new cup seal into insert on side of float bowl for intermediate choke shaft. Lip on seal faces outward (Fig. 29).

(6) Install secondary throttle valve lockout lever on boss of float bowl with recess in hole of lever facing inward (Fig. 29).

(7) Install choke coil lever on flats on intermediate choke shaft, install retaining screw, and tighten securely (Fig. 29). Lever is properly aligned when both the inside and outside levers face the fuel inlet.

(8) Install vacuum kick link in hole of the intermediate choke shaft lever. The end of the link faces toward the choke housing when installed correctly.

(9) Install lower inner choke rod lever into cavity in float bowl.

(10) Install choke housing to bowl, sliding intermediate choke shaft into lever. A pair of needle nose pliers may be used to hold lower lever in correct position while installing the choke housing (Fig. 30). The intermediate choke shaft lever and fast idle cam are in correct position when the tang on lever is beneath the fast idle cam.

(11) Install choke housing retaining screw and washer, tighten securely (Fig. 27).

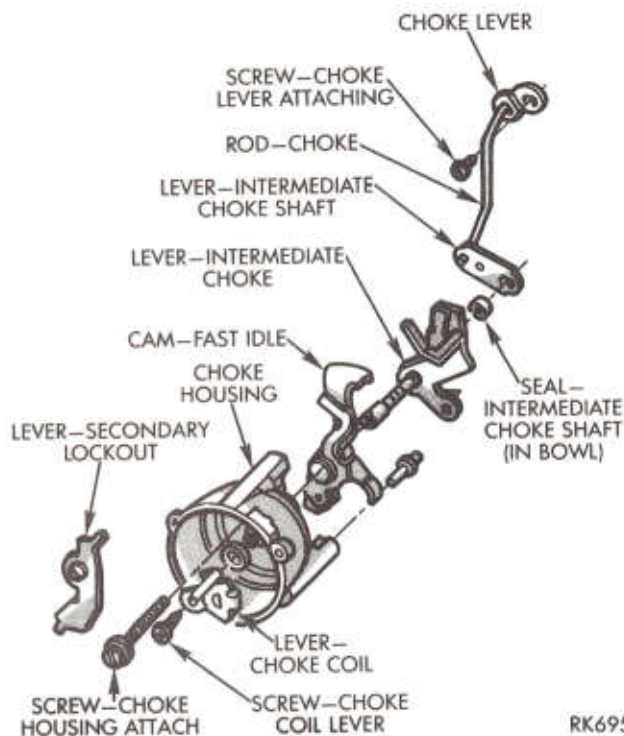
(12) If removed, install air baffle in secondary side of float bowl, with notches toward the top.

(13) If removed, install baffle inside of pump well with slot toward bottom.

(14) Install pump discharge ball and retainer screw (Fig. 22). Tighten screw securely.

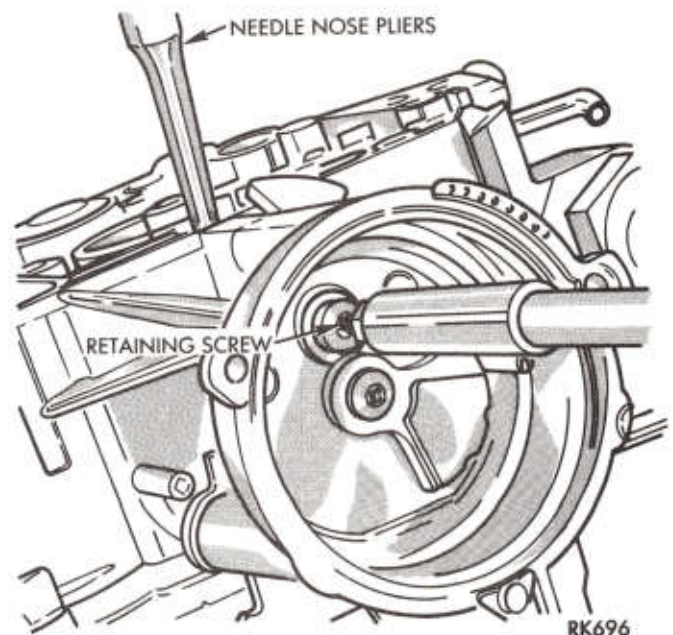
(15) If removed, carefully install primary metering jets in float bowl. Do not overtighten.

(16) Install float needle seat assembly with gasket.



RK695

Fig. 29—Choke Assembly



RK696

Fig. 30—Installing Choke Lever

(17) To make adjustment easier, carefully bend float arm upward at the notch in arm before assembly.

(18) Install float needle onto float arm by sliding float lever under needle pull clip. Proper installation of the needle pull clip is to hook the clip over the edge of the float on the float arm, facing the float pontoon.

(19) Install float hinge pin onto float arm with end of loop of pin facing pump well. Install float assembly by aligning needle in the seat, and the float hinge pin into locating channels in float bowl. Do not install float needle pull clip into holes in float arm (Fig. 21).

(20) Perform float adjustment.

(21) Install plastic filler block over the float needle (Fig. 20).

(22) Install power piston spring in the power piston well.

(23) If removed, install metering rods to hanger, making sure tension spring is attached to the top of each rod (Fig. 19).

(24) Install power piston into well making sure metering rods are properly positioned in metering jets. Press down firmly on plastic retainer until retainer is seated. If necessary, use a small drift punch and small hammer to tap retainer in place lightly.

(25) Install pump return spring in well.

(26) Install air horn gasket by sliding tab of gasket around metering rods and beneath power piston hanger. Position gasket over the two dowel pins on the float bowl (Fig. 16).

(27) Carefully lift corner of the air horn gasket and install pump plunger into pump well. Push plunger to

bottom of well against spring and place gasket over plunger stem.

(28) Install air horn.

AIR HORN INSTALLATION

(1) Hold down air horn gasket at the pump plunger location and carefully lower air horn onto float bowl. Check that bleed tubes, accelerating well tubes, and pump plunger are positioned through the holes in the air horn gasket. Do not force the air horn onto the bowl, but lower it lightly into place (Fig. 14).

(2) Install secondary air baffle deflector and air horn mounting screws. Tighten screws evenly and securely (Fig. 13).

(3) Install vacuum kick air valve rod into air valve lever. Install other end of rod into diaphragm plunger. Install vacuum diaphragm to bowl.

(4) Connect upper end of pump rod to pump lever by placing rod in lever hole noted at disassembly.

(5) Align hole in pump lever with hole in air horn casting using a punch or drift. Push lever roll pin into casting with a screwdriver until pin is flush with casting boss.

(6) Install metering rod hanger and metering rods and tighten screw securely (Fig. 11) work air valves up and down several times to check operation.

(7) Connect choke rod into lower choke lever inside bowl cavity. Install choke rod in upper choke lever and install choke lever.

(8) Install choke cover.

(9) Install solenoid idle stop.

(10) Install choke diaphragm hose.

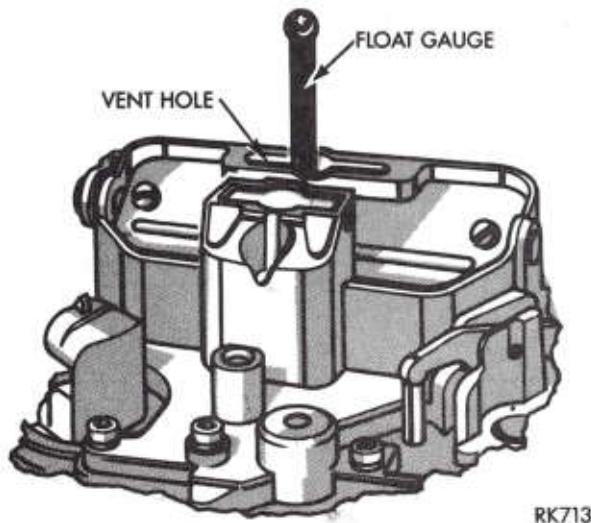
CARBURETOR ADJUSTMENTS

1. FLOAT LEVEL EXTERNAL CHECK

(1) With engine idling and choke wide open, insert gauge C-4900 (BT-8420A) in vent hole and allow gauge to float freely. **Do not press down on gauge as flooding or float damage may result.**

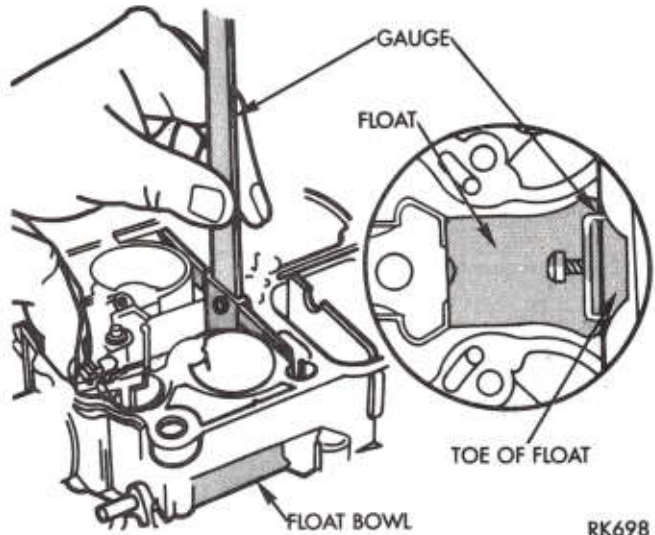
(2) Observe mark on gauge that lines up with top of casting. Setting should be within 1.58mm ($\pm 2/32$ inch) of specified float level setting. Incorrect fuel pressure will cause false readings.

(3) If float level is not to specifications, remove air horn and adjust float.



2. FLOAT ADJUSTING

Setting	Chrysler No.	Vendor No.
13/32 $\pm$ 2/32	4306419	17087175
13/32 $\pm$ 2/32	4306420	17087176
13/32 $\pm$ 2/32	4806424	17087177
15/32 $\pm$ 2/32	4306425	17086425
13/32 $\pm$ 2/32	4306431	17085431
15/32 $\pm$ 2/32	4306437	17087245



(1) Remove air horn, air horn gasket power piston assembly, and plastic float bowl insert.

(2) Hold float bowl retainer firmly in place.

(3) Push float down lightly against needle.

(4) Measure float height from top of casting to top of float at a point 3/16 inch from end of float (Fig. 2).

(5) Float level should be within 1/16 inch of specifications.

(6) If float level is too high, hold retainer in place and push down on center of float pontoon to obtain correct setting.

(7) If float level is too low, bend float upward to obtain correct setting. Recheck float level.

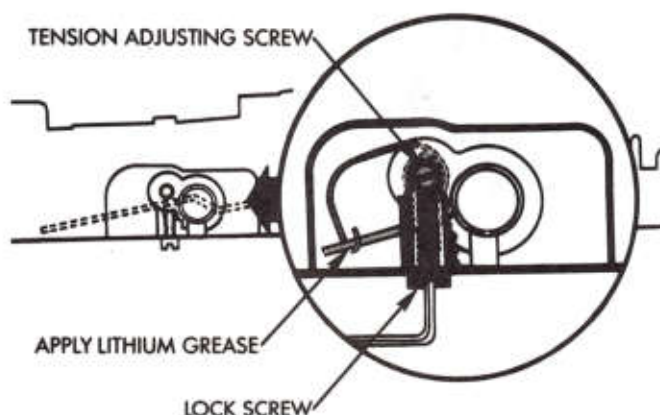
(8) Install plastic float bowl insert, power piston assembly and air horn gasket.

(9) Install air horn.

3. AIR VALVE SPRING ADJUSTMENT

Setting	Chrysler No.	Vendor No.
3/4 Turn	4306419	17087175
3/4 Turn	4306420	17087176
1 Turn	4306424	17087177
1/2 Turn	4306425	17086425
1/2 Turn	4306431	17085431
5/8 Turn	4306437	17087245

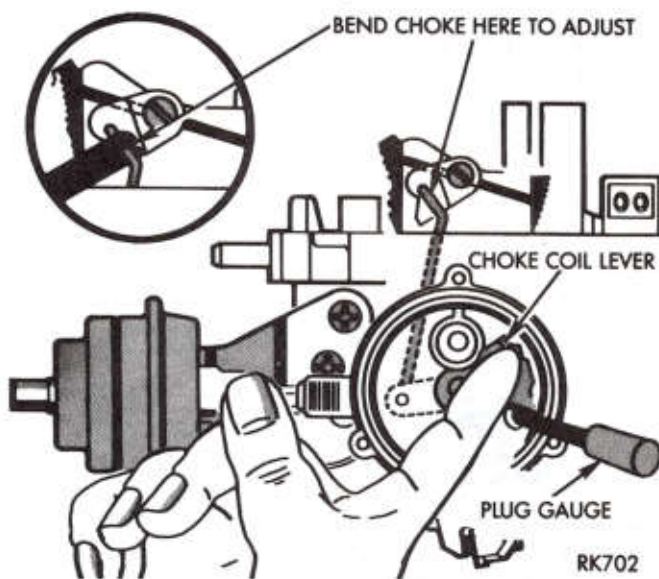
- (1) Loosen lock screw using 3/32 inch wrench.
- (2) Turn tension-adjusting screw counter-clockwise until air valve opens part way.
- (3) Turn tension-adjusting screw clockwise until air valve just closes. Then, turn adjusting screw clockwise the number of turns specified.
- (4) Tighten lock screw.
- (5) Apply lithium base grease to lubricate contact area.



RK701

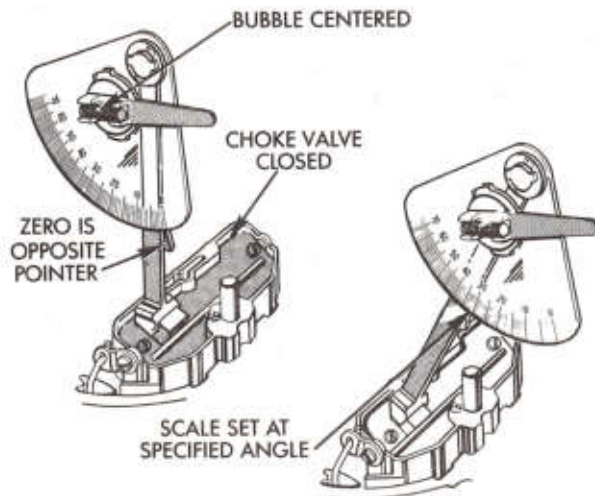
4. CHOKE COIL LEVER ADJUSTMENT ALL CARBURETORS

- (1) Remove choke cover.
- (2) Place fast idle cam follower on highest step of fast idle cam.
- (3) Push up on choke coil lever to close choke valve.
- (4) Insert a .120 inch plug gauge as shown.
- (5) Lower edge of lever should just contact gauge.
- (6) Bend choke rod to adjust.



5. USING CHOKE VALVE ANGLE GAUGE ALL CARBURETORS

- (1) Close choke valve.
- (2) Rotate degree scale until zero is opposite pointer.
- (3) Center leveling bubble.
- (4) Rotate scale to specified angle.
- (5) Adjust linkage to center the bubble.

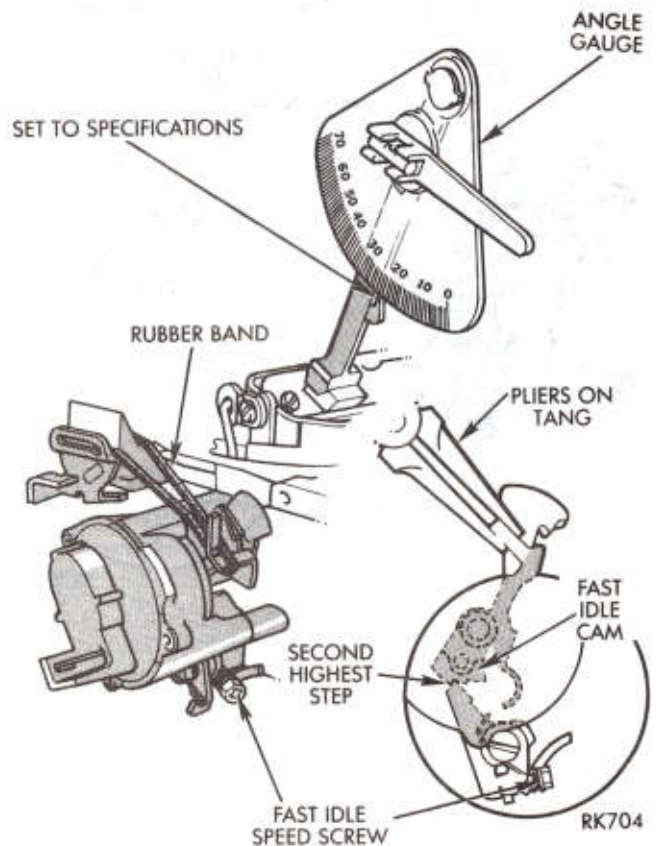


RK703

6. CHOKE ROD FAST IDLE CAM ADJUSTMENT (ANGLE GAUGE METHOD)

Setting	Chrysler No.	Vendor No.
20°	4306419	17087175
	4306420	17087175
	4306424	17087175
	4306425	17086425
	4306431	17085431
	4306437	17087425

- (1) Attach rubber band to green tang of intermediate choke shaft as shown.
- (2) Open throttle to allow choke valve to close.
- (3) Set up angle gauge and set angle to specifications.
- (4) Place cam follower on second highest step of cam against rise of high step. If cam follower does not contact cam, turn in fast idle screw until it does.
- (5) Adjust by bending tang of fast idle cam until bubble is centered.



RK704

7. CHOKE ROD FAST IDLE CAM ADJUSTMENT (PLUG GAUGE METHOD)

Setting	Chrysler No.	Vendor No.
.125"	4306419	17087175
	4306420	17087176
	4306424	17087177
	4306425	17086425
	4306431	17085431
	4306437	17087245

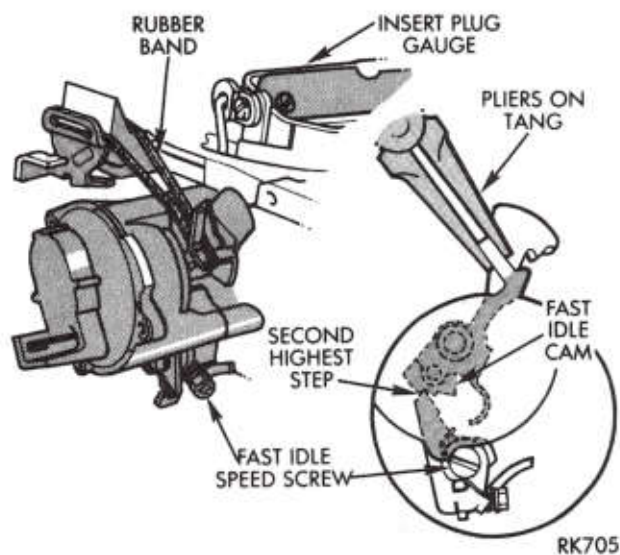
(1) Attach rubber band to green tang of intermediate choke shaft.

(2) Open throttle to allow choke valve to close.

(3) Place cam follower on second step of fast idle cam against rise of high step. If cam follower does not contact cam, turn in fast idle speed screw until it does.

(4) Apply a slight **opening** pressure on choke blade and insert specified plug gauge between top of choke blade and air horn casting.

(5) If adjustment is required, bend tang of fast idle cam until a slight drag is felt when gauge is withdrawn.



8. CHOKE VACUUM KICK ADJUSTMENT (ANGLE GAUGE METHOD)

Setting	Chrysler No.	Vendor No.
27°	4306419	17087175
27°	4306420	17087176
27°	4306424	17087177
23°	4306425	17086425
27°	4306431	17085431
23°	4306437	17087245

(1) Attach rubber band to green tang of intermediate choke as shown.

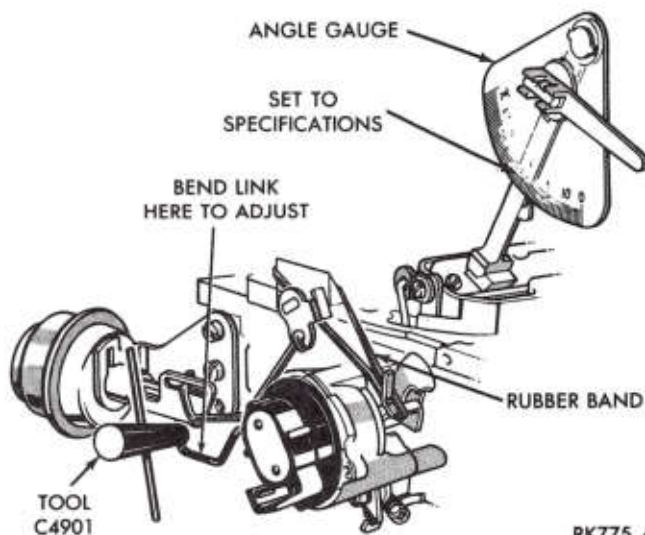
(2) Open throttle to allow choke valve to close.

(3) Set up angle gauge and set to specifications.

(4) Use tool C-4207A to apply at least 18 inches Hg to nipple on choke diaphragm. The air valve rod must not restrict plunger from retracting fully. If necessary, bend rod to permit full plunger travel. Final rod clearance must be set after vacuum kick setting has been made.

(5) With at least 18 inches Hg still applied, adjust by bending link as indicated to center bubble.

(6) Close choke valve, rotate gauge to zero, and check for centered bubble.



9. CHOKE VACUUM KICK ADJUSTMENT (PLUG GAUGE METHOD)

Setting	Chrysler No.	Vendor No.
.170"	4306419	17087175
.170"	4306420	17087176
.170"	4306424	17087177
.140"	4306425	17086425
.170"	4306431	17085431
.140"	4306437	17087245

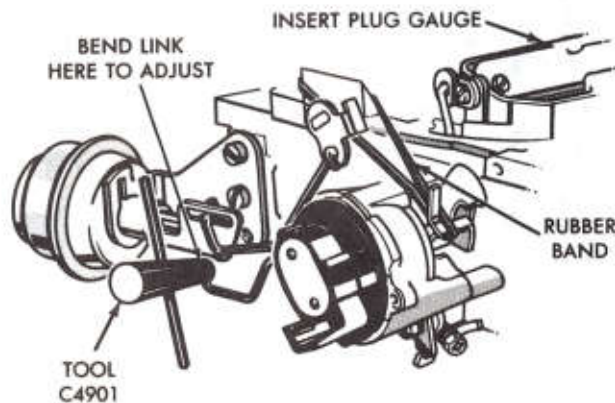
(1) Attach rubber band to green tang of intermediate choke shaft.

(2) Open throttle to allow choke valve to close.

(3) Use tool C-4207A to apply at least 18 inches Hg to nipple on choke diaphragm. The air valve rod must not restrict plunger from retracting fully. If necessary, bend rod to permit full plunger travel. Final rod clearance must be set after vacuum kick setting has been made.

(4) With at least 18 inches Hg still applied, apply a slight opening pressure on choke blade and insert specified plug gauge between top of choke blade and air horn casting.

(5) If adjustment is necessary, bend link as indicated until a slight drag is felt when gauge is withdrawn.



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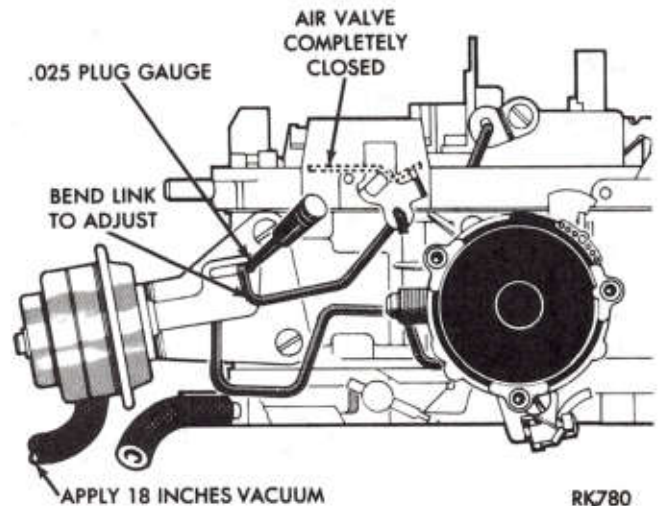
10. AIR VALVE ROD ADJUSTMENT ALL CARBURETORS

(1) Use tool C-4207-A to apply at least 18 inches Hg to vacuum nipple on choke vacuum diaphragm.

(2) Close air valve.

(3) Insert a .025 inch plug gauge between rod and end of slot.

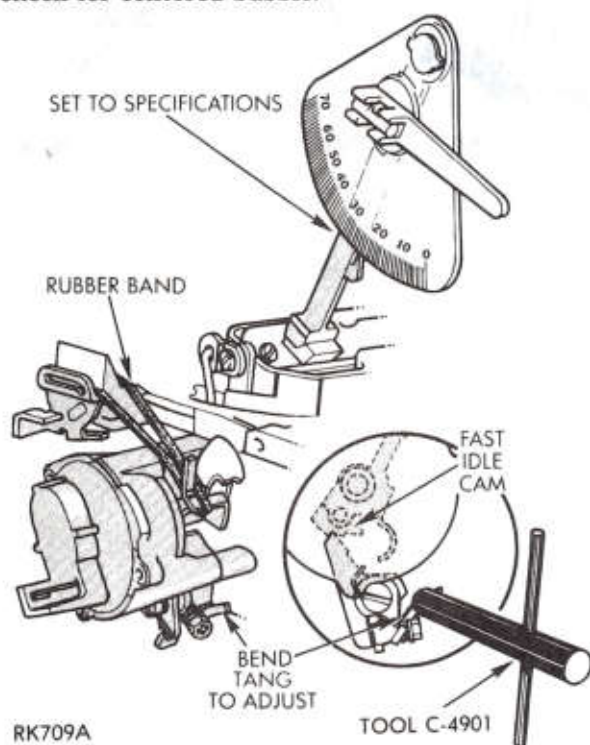
(4) Bend rod to adjust clearance to .025 inch.



11. CHOKE UNLOADER ADJUSTMENT (ANGLE GAUGE METHOD)

Setting	Chrysler No.	Vendor No.
38°	4306419	17087175
38°	4306420	17087176
38°	4306424	17087177
38°	4306425	17086425
38°	4306431	17085431
32°	4306437	17087245

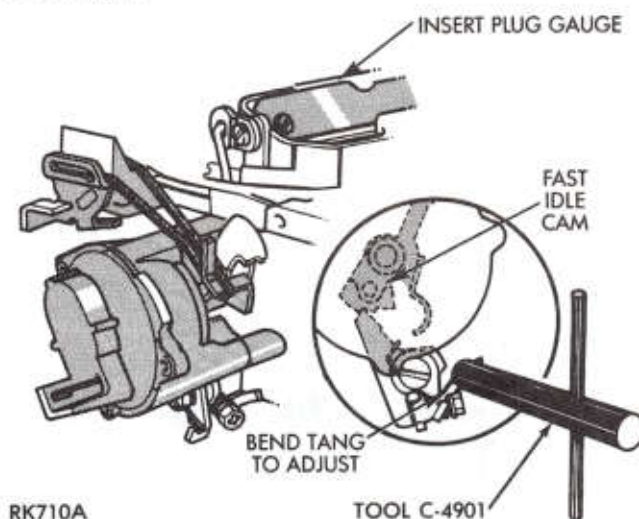
- (1) Attach rubber band to green tang of intermediate choke shaft.
- (2) Open throttle to allow choke valve to close.
- (3) Set up angle gauge and set angle to specifications.
- (4) Hold secondary lockout lever away from pin.
- (5) Hold throttle lever in wide open position.
- (6) Adjust by bending tang of fast idle lever until bubble is centered.
- (7) Close choke valve, rotate gauge to zero and check for centered bubble.



12. CHOKE UNLOADER ADJUSTMENT (PLUG GAUGE METHOD)

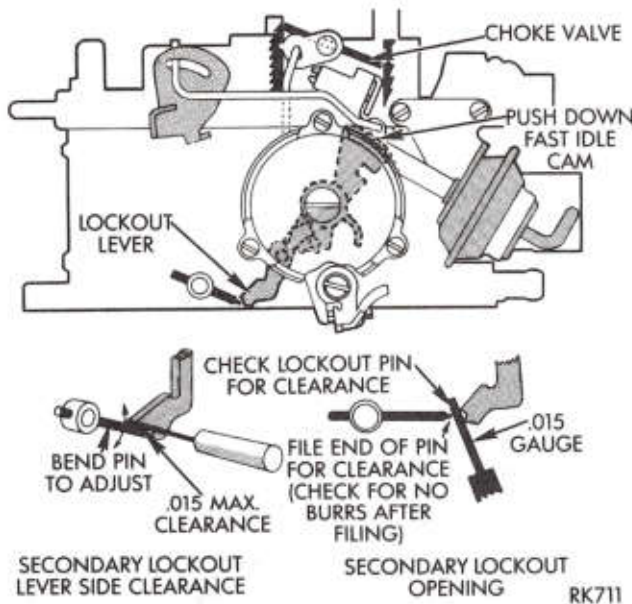
Setting	Chrysler No.	Vendor No.
.260"	4306419	17087175
.260"	4306420	17087176
.260"	4306424	17087177
.260"	4306425	17086425
.260"	4306431	17085431
.209"	4306437	17087245

- (1) Attach rubber band to green tang of intermediate choke shaft.
- (2) Open throttle to allow choke valve to close.
- (3) Hold secondary lockout lever away from pin.
- (4) Hold throttle lever in wide open position.
- (5) Apply a slight **opening** pressure on choke blade and insert specified plug gauge between top of choke blade and air horn casting.
- (6) If adjustment is required, bend tang of fast idle lever until a slight drag is felt when gauge is withdrawn.



13. SECONDARY LOCKOUT ADJUSTMENT ALL CARBURETORS

- (1) To check secondary lockout lever adjustment:
 - (a) close choke valve
 - (b) close throttle valve
 - (c) insert a .015 inch plug gauge as shown
 - (d) bend pin to achieve .015 inch clearance
- (2) To check secondary lockout opening clearance:
 - (a) hold choke valve wide open by pushing down on tail of fast idle cam
 - (b) insert a .015 inch plug gauge as shown
 - (c) file end of pin if necessary to achieve .015 inch clearance. Check that no burrs are left after filing.



14. SOLENOID IDLE RPM AND IDLE RPM ADJUSTMENT

Before checking or adjusting any idle speed, check ignition timing and adjust if necessary using the procedure shown in Group 8 Electrical. Disconnect and plug the vacuum hose at the EGR valve. Disconnect and plug the canister purge hose at the canister. Remove the PCV valve from the cylinder head cover and allow the valve to draw underhood air. Install tachometer and start and run engine until normal operating temperature is reached.

Solenoid RPM	Idle RPM	Chrysler Number	Vendor Number
850	Refer to	4306419	17087175
850	EAR Label	4306424	17087177
950		4306425	17086425
950		4306437	17087245

On a new vehicle (under 300 miles/500 km) reduce rpm settings by 75 rpm.

(1) Attach a jumper wire between solenoid coil terminal of the carburetor connector and battery positive post. Open throttle slightly to allow solenoid plunger to extend.

(2) Adjust solenoid plunger screw to specified speed.

(3) Remove tachometer, unplug and reconnect all hoses, reinstall PCV valve and air cleaner.

Idle speeds with the engine in normal operating condition (all hoses and wires connected) may vary from set speeds. Do not readjust.

15. IDLE RPM ADJUSTMENT

Before checking or adjusting any idle speed, check ignition timing and adjust if necessary using the procedure shown in Group 8 Electrical. Disconnect and plug the vacuum hose at the distributor and EGR valve. Disconnect and plug the canister purge hose at the canister. Remove the PCV valve from the cylinder head cover and allow the valve to draw underhood air. Install tachometer and start and run engine until normal operating temperature is reached.

Idle RPM	Chrysler No.	Vendor No.
Refer to EAR Label	4306419	17087175
	4306420	17087176
	4306424	17087177
	4306425	17086425
	4306431	17085431
	4306437	17087245

On a new vehicle (under 300 miles/500 km) reduce rpm settings by 75 rpm.

(1) If the engine rpm is not correct, turn the idle speed screw to obtain the correct idle rpm.

(2) Turn off engine. Unplug and reconnect all hoses.

Remove tachometer and reinstall PCV valve. Idle speeds with the engine in normal operating condition (all hoses and wires connected) may vary from set speeds. Do not readjust.

16. FAST IDLE SPEED ADJUSTMENT

Before checking or adjusting any idle speed, check ignition timing and adjust if necessary using the procedure shown in Group 8 Electrical. Disconnect and plug the vacuum hose at the distributor and EGR valve. Disconnect and plug the 3/16 inch diameter hose at the canister. Remove PCV valve from the cylinder head cover and allow the valve to draw underhood air. Connect a tachometer to the engine. Start and run engine until normal operating temperature is reached. Remove air cleaner. Plug heated air hose.

Idle RPM	Chrysler No.	Vendor No.
Refer to EAR Label	4306419	17087175
	4306420	17087176
	4306424	17087177
	4306425	17086425
	4306431	17085431
	4306437	17087245

(1) Open throttle slightly and place the fast idle adjusting screw on the second highest step of the fast idle cam.

(2) With the choke fully open, turn the fast idle adjusting screw until the correct fast idle rpm is obtained.

(3) Return engine to idle then reposition the adjusting screw on the second highest step of fast idle cam to verify fast idle speed. Readjust if necessary.

(4) Return engine to idle and turn engine off. Unplug and reconnect the vacuum hose at the EGR valve, canister, and air cleaner. Install air cleaner.

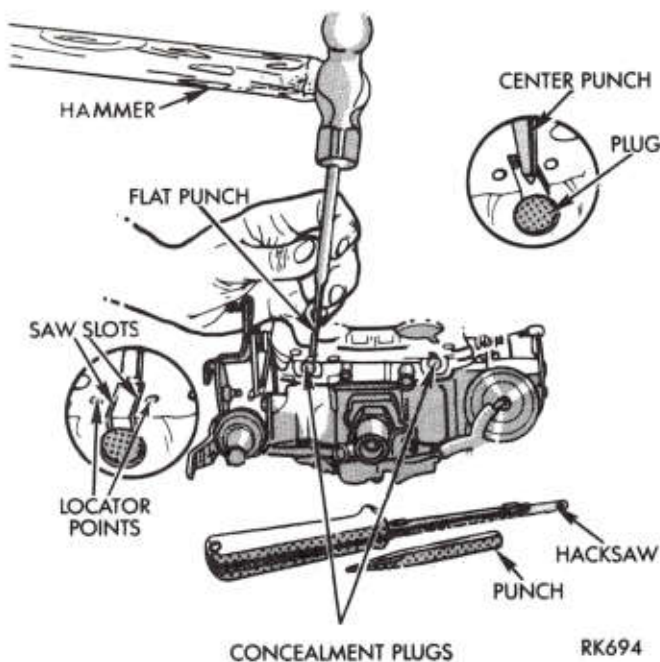
Idle speeds with engine in normal operating condition (all hoses and wires connected) may vary from set speeds. Do not readjust.

17. CONCEALMENT PLUG REMOVAL

(1) Invert carburetor and use hacksaw to make two parallel cuts in the throttle body. Make cuts on each side of the locator points beneath the concealment plug. The cuts should reach down to the plug but should not extend more than 1/8 inch beyond the locator points. The distance between the saw cuts will depend on the size of the punch to be used.

(2) Place a flat punch at a point near the ends of the saw marks in the throttle body. Hold the punch at a 45° angle and drive it into the throttle body until the casting breaks away, exposing the steel plug.

(3) Repeat the procedure for the other concealment plug.



18. PROPANE ASSISTED IDLE SET PROCEDURE

Idle RPM	Propane RPM	Chrysler Number	Vendor Number
Refer to EAR Label		4306419	17087175
		4306420	17087176
		4306424	17087177
		4306425	17086425
		4306431	17085431
		4306437	17087245

On a new vehicle (under 300 miles/500 km), reduce rpm settings by 75 rpm.

Tampering with the carburetor is a violation of Federal law. Adjustment of the carburetor idle air fuel mixture can only be done under certain circumstances as explained below. Upon completion of the adjustment, the concealment plugs must be replaced.

This procedure should only be used if an idle defect still exists after normal diagnosis reveals no other faulty condition such as incorrect basic timing, incorrect idle speed, faulty hose or wiring connections, etc.

Adjustment of the carburetor air fuel mixture should be performed after a major carburetor overhaul.

(1) Remove the concealment plug. Set the parking brake and place the transmission in neutral. Turn all lights and accessories off. Connect a tachometer to the engine. Start the engine and allow it to warm up on the second highest step of the fast idle cam until normal operating temperature is reached. Return the engine idle.

(2) Disconnect and plug the vacuum hoses at the EGR valve, the distributor.

(3) Disconnect the vacuum supply hose from the choke diaphragm at the carburetor and install the propane supply hose in its place. Other connections at the tee must remain in place. Apply vacuum to the heat air door actuator opening door.

(4) With the propane bottle upright and in a safe location, remove the PCV valve from the cylinder head cover and allow the valve to draw underhood air. Disconnect and plug the 3/16 inch diameter control hose from the canister.

(5) Open the propane main valve. Slowly open the propane metering valve until maximum engine rpm is reached. When too much propane is added, engine rpm will decrease. "Fine tune" the metering valve to obtain the highest engine rpm.

(6) With the propane still flowing, adjust idle speed screw to obtain the specified propane rpm "Fine tune" the metering valve again to obtain the highest engine rpm. If there has been a change in the maximum rpm, readjust the idle speed screw to obtain the specified propane rpm.

(7) Turn off the propane main valve and allow the engine speed to stabilize. Adjust the idle mixture screws 1/16 turn at a time, waiting 30 seconds between adjustments, until the smoothest idle at the specified idle rpm is obtained.

(8) Turn on the propane main valve. "Fine tune" the metering valve to obtain the highest engine rpm. If the maximum speed is more than 25 rpm different than the specified propane rpm, repeat steps (5) through (7).

(9) Turn off the propane main and metering valves. Remove the propane supply hose and reinstall choke vacuum hose. Install new concealment plugs. Perform the Idle rpm and Fast Idle Speed Adjustment.

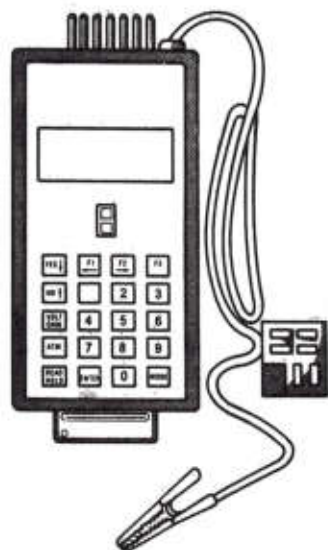
SPECIFICATIONS

The following specifications are published from the latest information available at the time of publication. If Curb Idle RPM or Ignition Timing differ from those of the Emission, Adjustment and Routing (EAR) Label, use the specifications on the label.

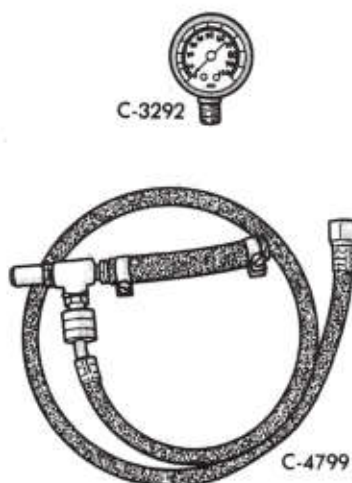
ROCHESTER QUADRAJET CARBURETORS

Chrysler Number	4306420	4306419	4306424	4306431
Vendor Number	17087176	17087175	17087177	17085431
Requirement	Fed.	Fed.	Fed./Alt.	Can./Can.
Engine	360/5.9L	360/5.9L	360/5.9L	360/5.9L
Transmission	Manual	Automatic	Manual	Both
Adjustments				
Float		13/32±2/32		
Air Valve Springs	3/4 Turn	3/4 Turn	1 Turn	1/2 Turn
Chock Coil Lever	.120"	.120"	.120"	.120"
Choke Rod Fast Idle Cam				
Angle Gauge Method	20°	20°	20°	20°
Plug Gauge Method	.125"	.125"	.125"	.125"
Choke Vacuum Kick				
Angle Gauge Method	.26°	.26°	.27°	.23°
Plug Gauge Method	.150"	.150"	.170"	.140"
Air Valve Rod	.025"	.025"	.025"	.025"
Choke Unloader				
Angle Gauge Method	30°	30°	33°	32°
Plug Gauge Method	.200"	.200"	.220"	.209"
Secondary Lockout	.015"	.015"	.015"	.015"
Solenoid Idle rpm	800	850	850	
Idle rpm		Refer to EAR Label		
Fast Idle rpm				
Propane rpm				
Chrysler Number	4306425		4306437	
Vendor Number	17086425		17087245	
Requirement	Can/Fed.		Can/Fed.	
Engine	360/5.9L		360/5.9L	
Transmission	Both		Both	
Adjustments				
Float		13/32±2/32		
Air Valve Springs	1/2 Turn		5/8 Turn	
Choke Coil Lever	.120"		.120"	
Choke Rod Fast Idle Cam				
Angle Gauge Method	20°		20°	
Plug Gauge Method	.125"		.125"	
Choke Vacuum Kick				
Angle Gauge Method	.23°		.23°	
Plug Gauge Method	.140		.140	
Air Valve Rod	.025"		.025"	
Choke Unloader				
Angle Gauge Method	38°		32°	
Plug Gauge Method	.260"		.209"	
Secondary Lockout	.015"		.015"	
Solenoid Idle rpm	950		950	
Idle rpm		Refer to EAR Label		
Fast Idle rpm				
Propane rpm				

SENSOR SPECIFICATIONS					
Component	Number of Terminals	Resistance at F°	Thread Compound	Thread Size	Torque
Coolant Temperature Sensor	2	7,000 to 13,000 Ohms About 21°C, 70°F	Preapplied (Nonrequired).	3/8-18 NPTF	27 N·m (20 ft.-lbs.)
		700 to 1,000 Ohms About 93°C, 200°F			
Throttle Body Temperature Sensor (5.2 Engine Only)	2	5,600 to 14,600 Ohms About 21°C, 70°F	Silicone Heat Transfer Compound P/N 4300277	M12 × 1.5 (Metric)	11 N·m (100 in.-lbs.)
		400 to 1,500 Ohms About 93°C, 200°F			



DIAGNOSTIC TOOL



C-4907

RR14G112

Special Tools

PROPELLER SHAFT AND UNIVERSAL JOINTS

CONTENTS

	Page		Page
GENERAL INFORMATION	1	SERVICE DIAGNOSIS	3
INSPECTION PROCEDURES	3	SERVICE PROCEDURES	5
PROPELLER SHAFT BALANCE	14	TIGHTENING REFERENCE	15

GENERAL INFORMATION

Drive line systems utilized for these vehicles employ tubular yoke propeller shafts with sliding spline yokes and cross type universal joints.

Four-wheel-drive vehicles have front propeller shafts using Saginaw C.V. (Constant Velocity) type universal joints with a bolted flange at the transfer case yoke, and a sliding splined yoke and universal joint with a strap attachment at the axle yoke end (Fig. 1).

The sliding spline and universal joint each have a lubricant fitting. The universal joints used in the constant velocity joint are lubricated at assembly and cannot be relubricated or reused if they are disassembled for any reason. The centering ball section between these two joints can be relubricated through a small fitting on the shaft yoke assembly.

Propeller shafts and couplings are balanced. In the event vehicle is to be undercoated, propeller shafts and universal joints should be covered to prevent undercoating material from getting on shafts and joints causing an unbalanced condition (Fig. 2).

No adjustments are provided to compensate for wear of universal joint parts. The universal joint should be reconditioned when excessive play exists between the bushings, bearings, and cross. If replacement of the cross is necessary, bearings, bushings, retainer, and seals should be also replaced. Avoid getting undercoating on these parts, causing unbalance and vibration.

When propeller shaft vibration is evident, make certain that correct rear spring shims are on vehicle. These parts provide the correct propeller shaft align-

ment. Always install a tapered rear spring shim, if so specified for the vehicle.

In some cases, vibration may be corrected by loosening center bearing mounting bolts, jacking up the rear wheels of vehicle and driving the propeller shaft with the engine. This will allow center bearing to seek its own alignment. After this is done, tighten mounting bolts securely.

Correct propeller shaft working angles are important to maximum parts life and performance together with proper lubrication maintenance.

Proper propeller shaft attaching parts such as bolts and nuts are vital to operation of vehicle systems. Always replace these parts with identical part numbers or their equivalents, when replacement becomes necessary. Likewise, specified torque standards must be strictly adhered to during reassembly.

All joints should be inspected every time the vehicle is serviced. When leaks or damage is evident, consider replacement of universal joint. For lubrication information, see Group 0 "Lubrication and Maintenance" in this service manual.

Unbalance in the propeller shaft system due to damage or accumulation of dirt and other foreign matter or loose worn parts can cause unnecessary vibration in the drive line. Another possibility of propeller shaft vibration is misalignment of rear axle. Shifting of the rear axle can be caused by spring U-bolts becoming loose and spring center bolt breaking.

Clean all parts using suitable cleaning fluid. Allow parts to remain in cleaner for some time to loosen up any particles of grease or foreign matter. Remove any burrs or rough spots from machined surfaces.

• **Needle Bearings**—Do not disassemble. Clean with short stiff brush and blow out with compressed air. Work a small quantity of lubricant (140 SAE Oil) into each bearing cap and turn the needle bearing on the trunnion to check wear.

• **Journal Cross**—Because worn needle bearings used with a new journal cross, or new needle bearings used with a worn journal cross, will wear more rapidly making another replacement necessary in a short time, always replace journal cross and four needle bearing caps as a unit.

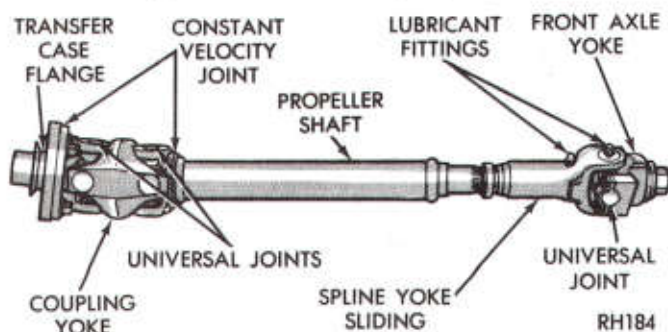


Fig. 1—Propeller Shaft

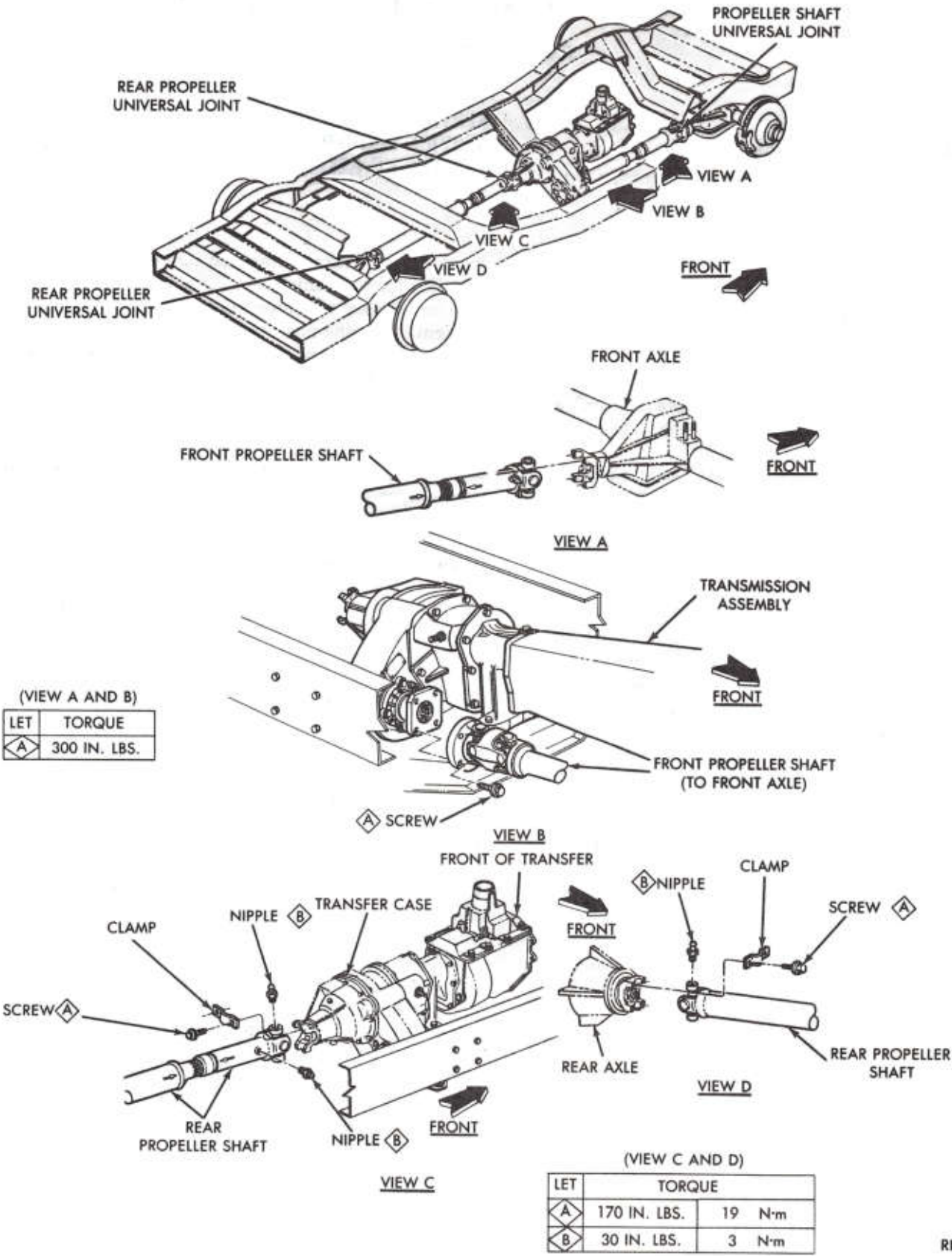


Fig. 2—Propeller Shaft (Front and Rear)

Alignment of the rear axle can be checked by measurement. When shims are removed for any reason they should be marked and installed in the same position.

All tightening torques are referenced in illustrations and are also listed in specifications data at the rear of this group.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
UNIVERSAL JOINT NOISE	(a) Improper lubrication.	(a) Lubricate.
	(b) Worn universal joint bearings.	(b) Replace bearings and/or damaged distorted yokes.
	(c) Defective or loose propeller shaft flange bolts or clamps.	(c) Tighten as specified.
PROPELLER SHAFT VIBRATION	(a) Loose universal joint yoke or loose attaching clamps or U-bolts.	(a) Replace and tighten as specified.
	(b) Distorted or damaged yokes.	(b) Install new yokes.
	(c) Propeller shaft out of balance.	(c) Check for foreign material on propeller shaft.
	(d) Misalignment of rear axle.	(d) Tighten or replace spring U-bolts.
	(e) Yokes out of parallel to each other.	(e) Change propeller shaft. Change yoke.
	(f) Rear axle or transmission yoke runout.	(f) Replace with new yokes.
	(g) Yokes out of phase on multiple shaft installations.	(g) Correct phasing.
	(h) Improper match of joint working angles.	(h) Shim axle.
	(i) Worn universal joint bearings.	(i) Replace bearings and/or damaged distorted yokes.

INSPECTION PROCEDURES

UNIVERSAL YOKES (BEFORE MEASURING ANGULARITY)

Before checking yoke angles, the yoke must be inspected for lug distortion or damage. Be sure that shaft nut is tightened to the correct torque before yoke inspection. A straight piece of round bar stock, which is a slip fit in the universal yoke bearing bore, can be used as a gauge bar.

Inspection (Method No. 1)

(1) If gauge bar is a slip fit through both bearing bores simultaneously, bores are properly aligned and yoke is not distorted or damaged.

(2) If bar goes through one bearing bore, but strikes inner face of opposite lug, yoke is distorted and must be replaced.

Inspection (Method No. 2)

In the event a gauge bar of the proper diameter is not available, yoke distortion can be checked with a level protractor in the following manner:

(1) Remove burrs or nicks from yoke outer lug faces and machined surface of bearing retainers.

(2) Turn yoke so that bearing bores are horizontal.

(3) Hold level protractor vertically on one lug outer face or on machined surface of bearing retainer. Adjust protractor so that scale reads zero or 90 degrees when bubble is centered between the two marks on tube.

(4) Next, place protractor in same location on opposite lug face or bearing retainer and note position of the bubble.

(5) If necessary, reset scale so that bubble falls exactly between marks on tube. If scale setting must be changed more than 1/2 degree, yoke is probably distorted and should be replaced.

TRANSFER CASE YOKE HORIZONTAL

Horizontal alignment of the yoke is as important as vertical alignment. Tools needed are:

- A straightedge of a length 20 to 40 inches (508 to 1016mm) longer than the track of the rear wheels.
- Two large and two small C-clamps.
- A steel tape measure.
- A large carpenter's square.

Check condition of engine rear mounts. Worn or loose engine or transmission mounts could cause misalignment and give an inaccurate measurement.

(1) Locate vehicle on level floor or level it across its transverse section to eliminate possibility of incorrect readings.

(2) Clamp the long straightedge at right angles to side frame members. Check the 90 degree angle with the large carpenter's square.

(3) Clamp shorter straightedge to yoke face so it is parallel to the floor. Check the horizontal angle of this straightedge with a spirit level. It must be exactly level to make accurate measurements.

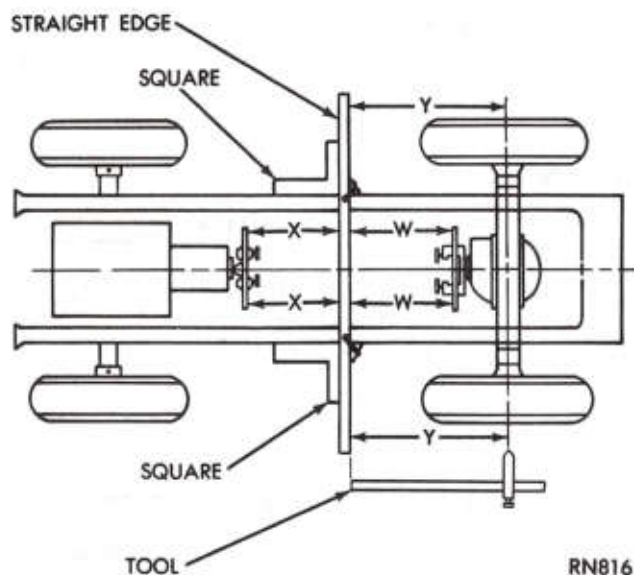


Fig. 3—Alignment Inspection

(4) Measure distance "X" between the two straightedges at both ends of the shorter one with the tape measure. The tape must be held parallel to the sides of frame.

(5) The two dimensions should be within 1/16 inch (1.58mm) of each other. If they are not, yoke is not properly aligned.

Horizontal alignment of transmission yoke can be checked in same manner as outlined in proceeding steps. However, substitute a straight piece of round bar stock. Make sure bar is snug fit in bearing bores. Otherwise, drive a wooden wedge between it and end of yoke shaft.

PINION YOKE HORIZONTAL

When vehicle does not run straight in evidence, for example, by presence of dog-tracking, three common causes of horizontal misalignment are:

- Loose or sheared spring seat dowels.
- Loose spring clips.
- Loose spring shackle brackets.

Before inspecting pinion yoke for horizontal misalignment, first check the tracking of the rear wheels.

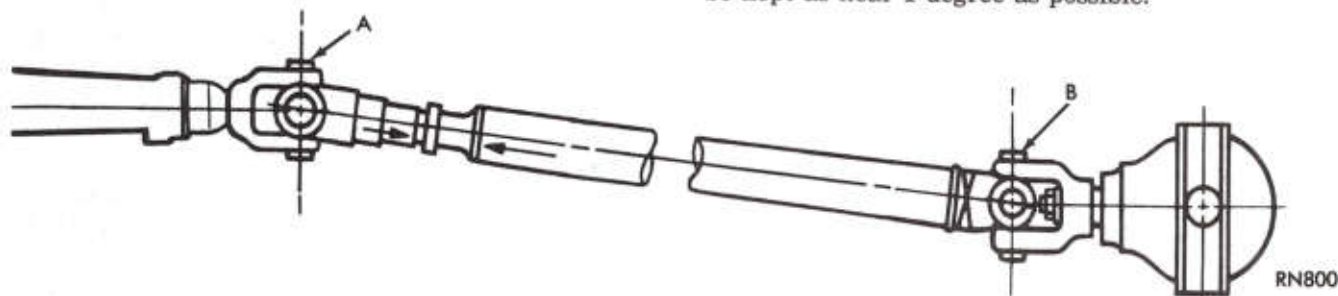


Fig. 4—Yoke Alignment (Single Shaft)

A tool for this purpose can be made of drill rod.

(1) Fabricate this tool from a long piece of 1/2 inch (12.7mm) drill rod and a short piece of 3/4 inch (19mm) rod, one end ground to a point (Fig. 3).

Drill a 1/2 inch (12.7mm) hole through the 3/4 inch (19mm) rod near end opposite pointer to accommodate the 1/2 inch (12.7mm) rod. Drill and tap an intersecting hole in same end to permit use of a small set screw.

(2) Measure the distance "Y" from the straightedge to centers of the rear axle with the fabricated tool. In the event dimensions vary more than approximately 1/8 inch (3mm), check for one or more of the three common causes.

(3) Clamp the short straightedge to pinion yoke (or use round bar and wedge if pinion is fitted with a yoke), so bar is parallel to floor. Check the horizontal angle of the straightedge or bar with a spirit level.

(4) Measure distance "W" between two straightedges at both ends of the shorter one with a tape measure. Be sure tape is held parallel to frame.

(5) Dimensions should be within 1/16 inch (1.58mm) of each other. In the event they are not, yoke is misaligned and should be replaced.

YOKE VERTICAL (SINGLE SHAFT)

To accurately check drive line alignment, vehicle must be on the floor with weight of vehicle resting on all four wheels. Tighten spring clips (U-bolts), check center bearing support and bracket for correct length (if so equipped). Check stamped arrows on yoke and propeller shaft for correct alignment.

(1) On one-piece propeller shafts, rotate shaft until transfer yoke is in exact vertical position (Fig. 4).

(2) Place a level protractor on yoke bearing "A" parallel to shaft. Adjust protractor so bubble in spirit level is centered. Note reading on protractor scale.

(3) Place level protractor on yoke bearing "B" (parallel to shaft). Adjust protractor so bubble in spirit level is centered. Note reading on protractor scale.

(4) The difference in protractor readings taken at "A" and "B" indicates amount of yoke misalignment. The vertical alignment of one-piece shaft yokes should be kept as near 1 degree as possible.

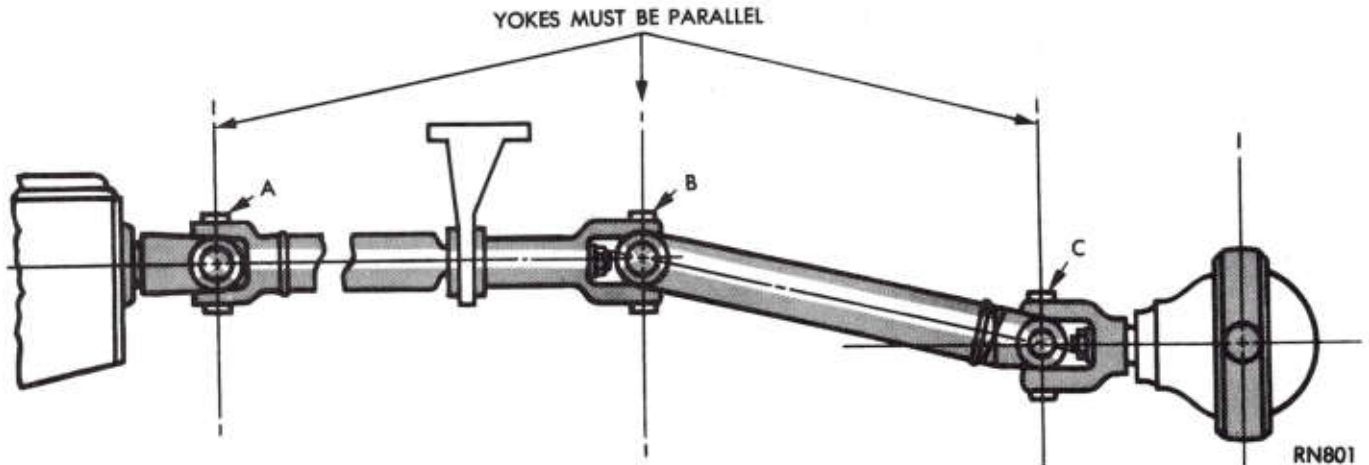


Fig. 5—Two-Piece Shaft Yoke, Vertical Alignment

Correction

Incorrect yoke vertical alignment is generally caused by rear axle pinion yoke misalignment and/or incorrect center bearing bracket length. If a pinion yoke is found to be misaligned, check for loose spring to axle U-bolts, allowing the axle housing to rotate on the springs. Check for broken springs or worn spring shackles, and bracket pins and bushings. These should be corrected if found abnormal.

YOKE VERTICAL (TWO-PIECE SHAFT)

- (1) On two-piece propeller shafts, rotate shaft until transmission yoke is in vertical position (Fig. 5).
- (2) Place a level protractor on yoke bearing "A" (parallel to shaft). Adjust the protractor so the bubble in spirit level is centered. Note reading on the protractor scale.
- (3) Perform the same operation on yoke bearings "B" and "C" with protractor parallel to shaft. Note protractor scale readings as both "B" and "C".

(4) The difference in protractor readings taken at "A", "B" and "C" indicates the amount of yoke misalignment. The vertical alignment of the two-piece shaft yokes should be kept as near 1 degree as possible.

Drive line disturbances that are not associated with balance or runout, such as not continuing or to worsen as speed increases, will be most responsive to rear axle pinion adjustments. This includes center bearing adjustments for the two or three propeller shaft installations.

Correction

- (1) Adjustment of the pinion yoke vertical alignment is accomplished by installing tapered shims between the rear springs and saddle of the rear axle.
- (2) If the yoke alignment is found to be off at the front shaft, or shafts in vehicles using a two-piece shaft, the center bearing brackets should be checked for correct length. Shims may be used between the support bracket and frame crossmember to correct out of alignment, if necessary.

SERVICE PROCEDURES

SINGLE-PIECE PROPELLER SHAFT

There are two types of single-piece shafts.

- **Outboard slip type** as used on D100, D250, and D350 models with long transmission extension.
- **Inboard slip type** as used on W150, W250, and W350 models.

Removal—Rear

- (1) Mark shaft and pinion hub yoke to reinstall in same position.
- (2) Remove both rear universal joint roller and bushing assembly clamps from rear axle drive pinion hub yoke. **Do not disturb the retaining strap used to**

hold bushing assemblies on universal joint cross, if so equipped.

Do not allow propeller shaft to drop or hang loose from either joint during removal. Wire up or otherwise support the loose end of propeller shaft to prevent damage to joint.

Before removing propeller shaft with sliding yoke from transmission, the vehicle front end should be lowered slightly to prevent the loss of transmission fluid.

Removal—Front

- (1) Slide propeller shaft with the front yoke from the transmission output shaft. **Be careful not to**

damage splines on output shaft or yoke. Examine sliding yoke seal for evidence of leakage. If no leakage is evident, do not disturb seal. If necessary to replace the seal, see Transmission Group, 21.

It is important to protect the machined surface of the sliding yoke from damage after propeller shaft has been removed.

Installation—Front

(1) Before installing propeller shaft, wipe sliding yoke clean and inspect machined surface for scratches, nicks, or burrs, and correct as necessary.

(2) Engage the yoke splines on end of output shaft, being careful not to burr the splines.

Installation—Rear

(1) Install rear universal joint cross and roller bushings in the seats of drive pinion hub yoke, aligning marks made during removal. Install bushing clamps and attaching screws. Tighten to specifications.

PROPELLER SHAFT—TWO-PIECE

Removal—Rear Shaft

(1) Mark shaft and pinion hub yoke to reinstall in same position. Also mark center bearing spline and slip yoke.

Do not allow propeller shaft to drop or hang loose from either joint during removal. Wire up or otherwise support the loose end of propeller shaft to prevent damage to joint.

(2) Remove both rear universal joint roller and bushing assembly clamps from rear axle drive pinion hub yoke. **Do not disturb the retaining strap used to hold bushing assemblies on universal joint cross, if so equipped.** Slide rear shaft off the splines of front shaft at center bearing and remove shaft from vehicle.

Removal—Front Shaft

(1) From the transmission end of propeller shaft, remove the bushing retaining bolts and clamps (or flange nuts if equipped with brake). Mark parts to reinstall in same position.

(2) Remove the two center bearing mounting nuts and bolts and remove shaft with center bearing from vehicle.

Installation—Front Shaft

(1) Position front end of shaft, aligning marks made during removal and start all attaching bolts and nuts at front universal and center bearing.

(2) Tighten 1/4 inch clamp bolts to 170 in. lbs (19 N·m) or 5/16 inch clamp bolts to 300 in. lbs. (34 N·m). If equipped with brake, tighten universal flange nuts to 35 ft. lbs. (47 N·m). Leave center bearing bolts just snug.

Installation—Rear Shaft

(1) Align marks made during removal and slide yoke on splined front shaft.

(2) Align marks made during removal while positioning rear universal in axle hub yoke.

(3) Install bushing clamps and bolts.

(4) Tighten 1/4 inch bolts to 170 in. lbs. (19 N·m) or 5/16 inch bolts to 300 in. lbs. (47 N·m).

(5) Jack up the rear wheels and drive the propeller shaft with the engine. This will allow the center bearing to seek its own alignment. After this is done, tighten the center bearing support mounting bolts to 50 ft. lbs. (68 N·m).

WORKING ANGLE CORRECTION

All universal joints must be set up to operate at a small angle if it is to operate without bearing failure for an extended period of time.

(1) On all models equipped with two-piece propeller shafts, front shaft and rear shaft must be misaligned by at least 1/2 of a degree from transmission and from each other.

(2) On models equipped with a two-piece propeller shaft, rear axle pinion must be parallel to front shaft.

(3) On two-piece propeller shaft assemblies, working angles differ according to length. The center joint angle can be adjusted by changing center bearing brackets. Adjusting working angle at rear joint is accomplished by installing tapered shims between rear springs and saddle of rear axle.

UNIVERSAL JOINT CROSS AND ROLLER (Figs. 6 and 7)

Disassembly

(1) Hammer bushings slightly inward to relieve pressure from snap rings and remove snap rings.

(2) Position yoke in press or vise with a socket large enough to receive bushing on one side and a socket slightly smaller than bushing on the other side.

(3) With pressure applied, one roller will move into yoke and opposite roller will move into receiving socket.

(4) After one roller is out, press on cross end to move opposite roller into receiving socket. Discard cross and rollers.

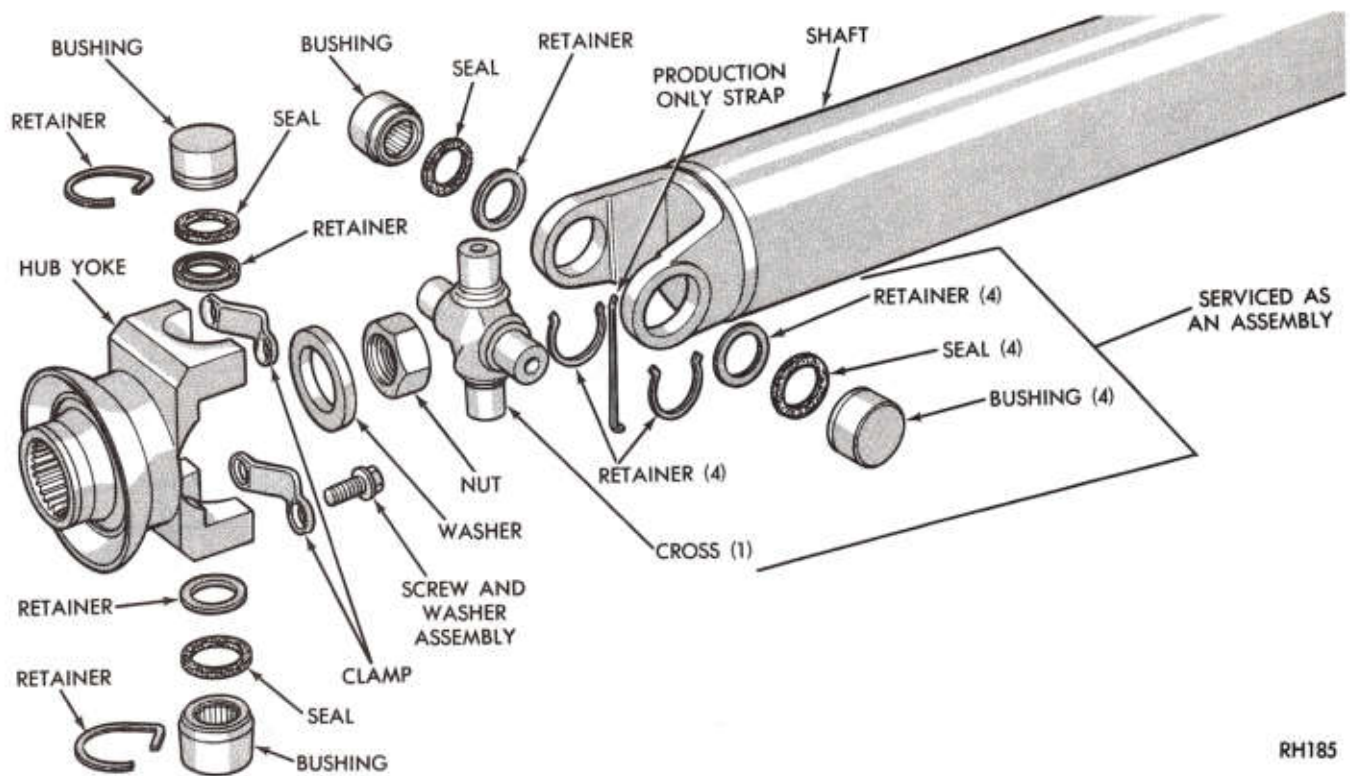
UNIVERSAL JOINT CROSS PACKAGE

Assembly

(1) Position yoke in vise or press with new bushing assemblies and new cross assembly.

(2) As pressure is applied, guide cross ends into bushing and roller assemblies.

(3) Press bushings just far enough in to expose snap ring grooves and install new snap rings.



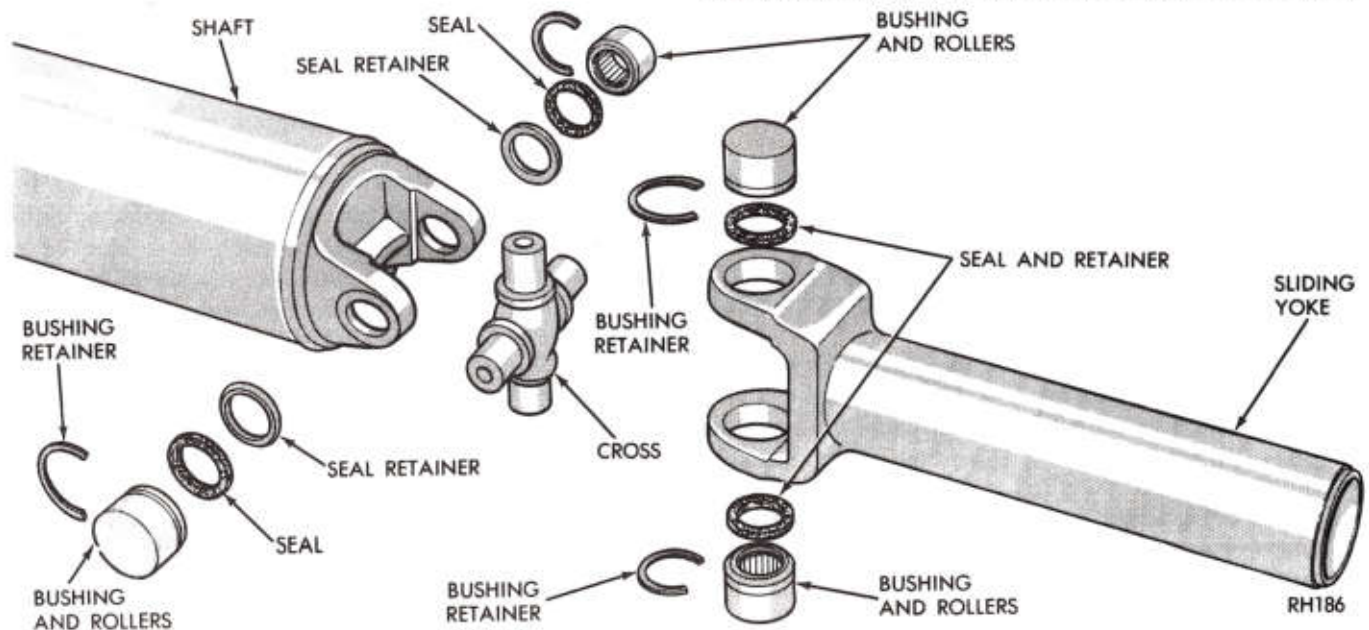
RH185

Fig. 6—Hub Yoke Type Universal Joint

(4) When second yoke is not used, install bushings with snap rings on cross ends and hold them in place with tape or wire until installation of propeller shaft.

CENTER BEARING

When two or more propeller shafts are used in tandem, a rubber mounted center bearing supports the center portion of drive line. This type of assembly



RH186

Fig. 7—Sliding Yoke Type Universal Joint

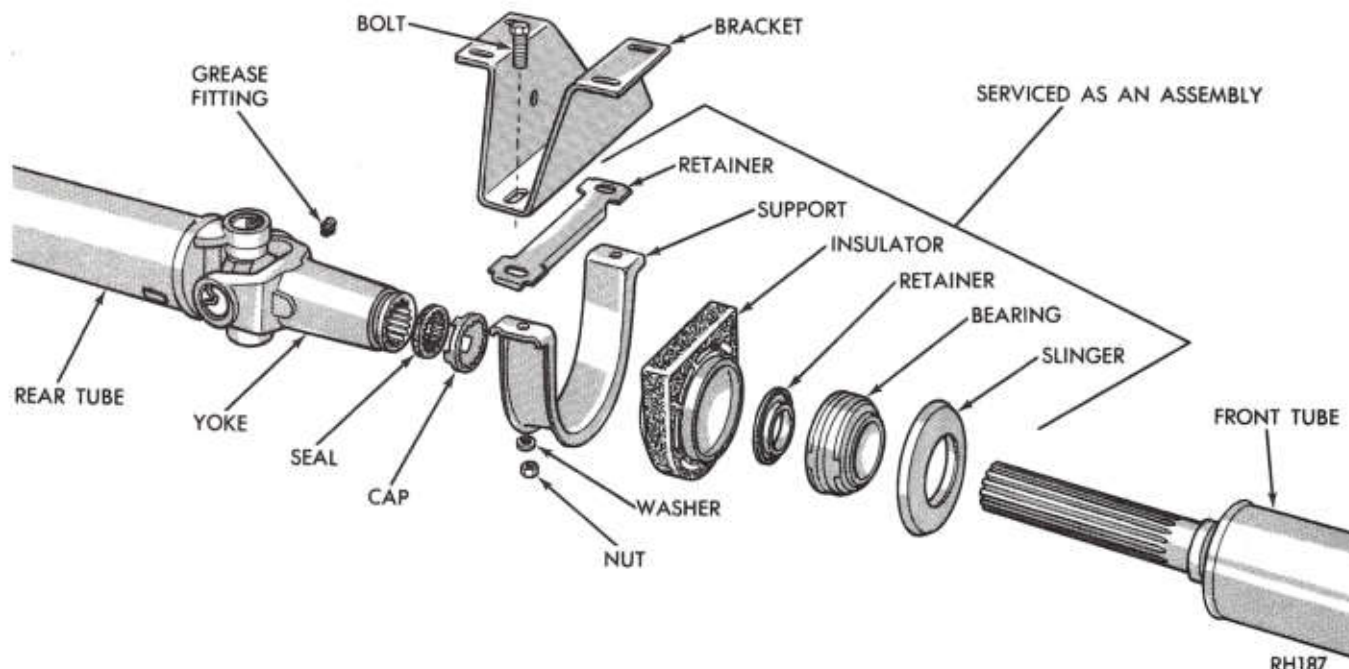


Fig. 8—Slip Yoke Center Bearing

is supported in a bracket which is bolted to frame crossmember (Fig. 8).

Removal and Disassembly

- (1) Mark parts for reassembly and remove propeller shafts as previously described.
- (2) Place front shaft in vise and pull bearing support and insulator from bearing. Discard parts.
- (3) Bend slinger away from bearing with hammer to obtain clearance to install bearing puller.
- (4) Remove bearing with puller and remove slinger. Discard all parts because replacement package includes complete bearing assembly plus slinger and retainer.

Assembly and Installation

- (1) Place new slinger, bearing assembly, and retainer on shaft. Each part is a press fit on splined shaft.
- (2) Using a strong tube or pipe which clears splines, press or drive parts forward on shaft until they bottom on shoulder.
- (3) If seal on rear shaft slip yoke requires replacement, pry cap from yoke and discard seal and cap.
- (4) Place new seal cap and felt seal on center bearing splines, to be final assembled to yoke after propeller shafts are installed.
- (5) Install front and rear propeller shafts as previously described. Slide seal and cap to yoke and crimp cap tabs to yoke.

ALIGNMENT OF UNIVERSAL JOINT YOKE

All propeller shaft slip joints and yokes with splined couplings are provided with arrows for easy matching (Fig. 9). The arrows are stamped on these parts during initial assembly and balancing.

Make certain arrows are in line. This aligns yokes on parallel planes and maintains original balance of shaft assembly. Check for arrow alignment marks before removing or disassembling propeller shaft. If arrows are not legible, center punch mark the shafts and yokes to insure that propeller shaft will be reassembled for alignment correctly.

Propeller shafts with tube yokes welded in each end, have the center lines through bearing bores of both yokes aligned to each other during welding.

When propeller shaft has a spline at one end to receive a slip yoke, slip yoke must be installed so that center line through its bearing bores is in line with center line through yoke bores at other end of tube. This alignment is checked by eye because one spline equals more than twenty degrees of misalignment.

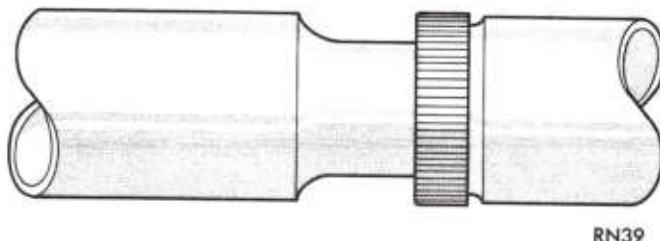


Fig. 9—Matching Propeller Shaft Slip Yoke

Single propeller shafts made with a slip yoke at one end, have alignment arrows stamped on yoke and tube. Arrows are stamped on these parts during initial assembly and balancing. Be sure these arrows are lined up. This aligns yokes and maintains original balance of shaft assembly. Check for arrow alignment marks before removing or disassembling propeller shaft. When arrows are not legible, center punch shafts and yokes so they may be reassembled in correct alignment.

Joint Phasing

A propeller shaft, with a sliding spline yoke, is properly phased when the yoke ears at each end of the shaft are on the same plane (Fig. 10).

On multiple-shaft installations, proper joint phasing is accomplished by considering each shaft separately.

SLIP JOINT

Disassembly

When propeller shaft has been removed, look for

arrow marks on shaft and slip yoke. When marks are not discernible, punch mark both members insuring reassembly in exactly same relative position. When marked, unscrew dust cap and withdraw shaft. Remove washer, steel washer, and dust cap from shaft.

Cleaning and Inspection

Clean all dirt and old grease from slip yoke; slip yoke spline and shaft splines, using a suitable cleaning fluid. Inspect slip yoke splines for wear or evidence of twisting. Check clearance between slip yoke splines and shaft splines. Worn parts must be replaced when backlash is excessive.

Assembly

(1) With dust cap positioned on shaft, install washers on shaft. Coat shaft splines with lubricant specified in "Group 0, Lubrication".

(2) Align arrows on splined shaft and slip yoke, then insert shaft into slip yoke. Make certain yokes on both joints are aligned. Journal crosses must be in same plane or serious vibration damage could occur.

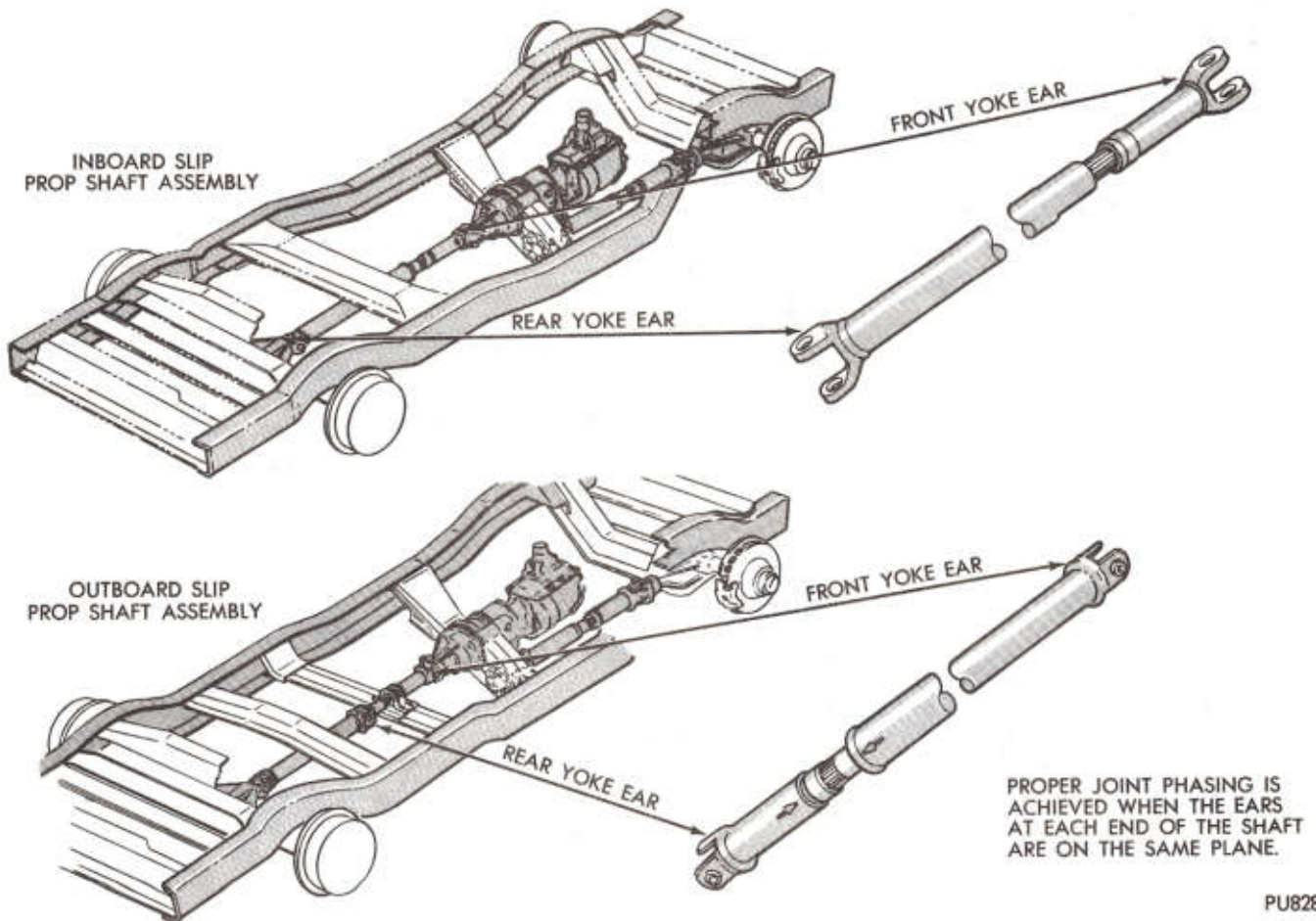


Fig. 10—Propeller Shaft Yoke Ears on Same Plane

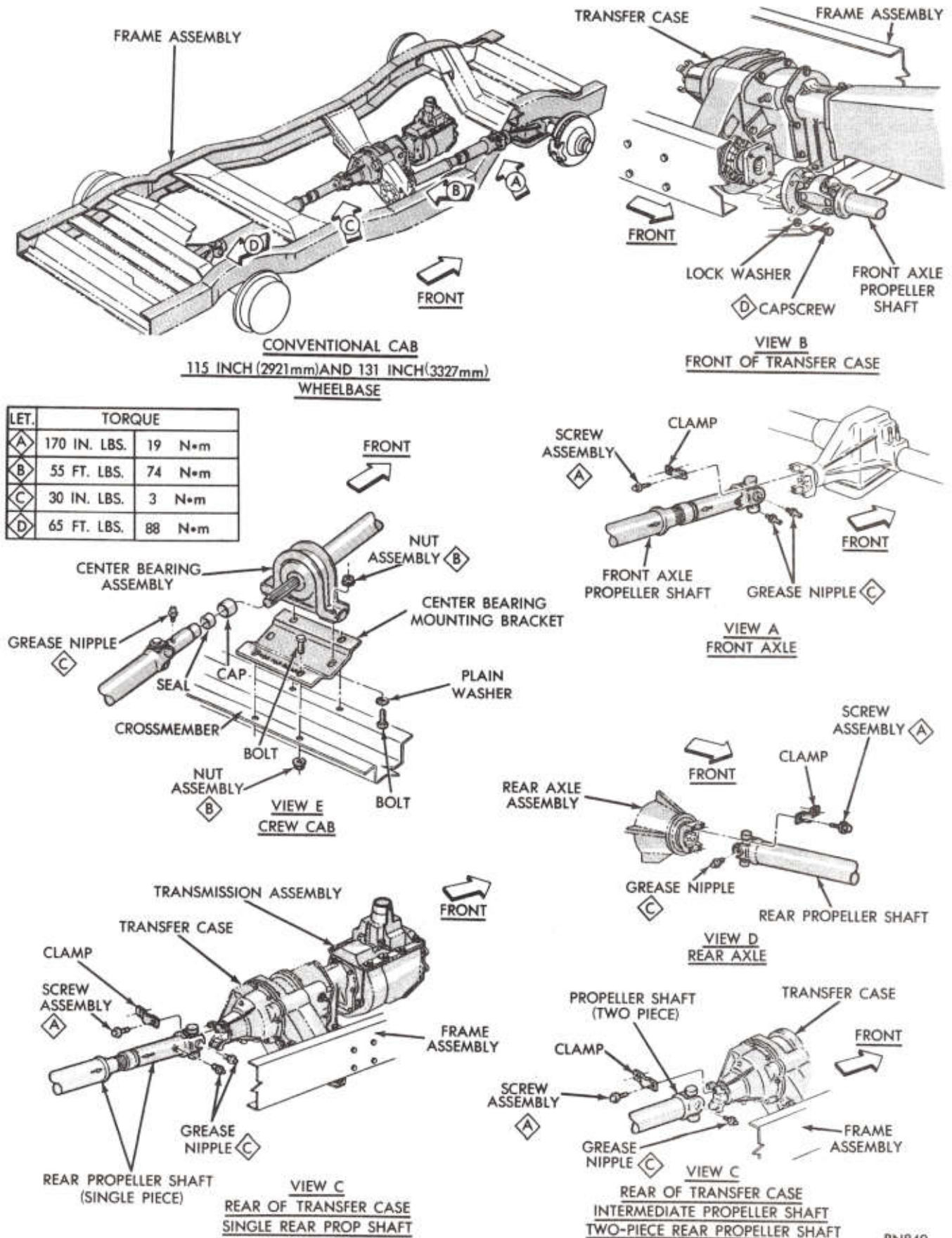


Fig. 11—Drive Line Components (W150, W250, and W350)

RN840

(3) Install dust cap on slip yoke end. Hand tighten dust cap. Avoid use of wrench which will damage cork or felt washer.

(4) Install lubrication fitting in slip yoke.

FRONT PROPELLER SHAFT (Fig. 11) (7260 for Vehicles W150, W250, W350 and AW150 Series)

Removal

(1) Remove skid plate if so equipped.

Do not allow propeller shaft to drop or hang loose from either joint during removal. Wire up or otherwise support the loose end of propeller shaft to prevent damage to joint.

(2) Remove 4 flange retaining screw and lock-washer assemblies from constant velocity universal joint at transfer case.

(3) To prevent constant velocity universal joint from rotating while removing the four flange retaining bolts, utilize a press bar.

(4) Mark shaft and pinion hub yoke to reinstall in same position.

(5) Remove both rear universal joint roller and bushing assembly clamps from rear axle drive pinion hub yoke. Do not disturb the retaining strap used to hold bushing assemblies on universal joint cross, if so equipped.

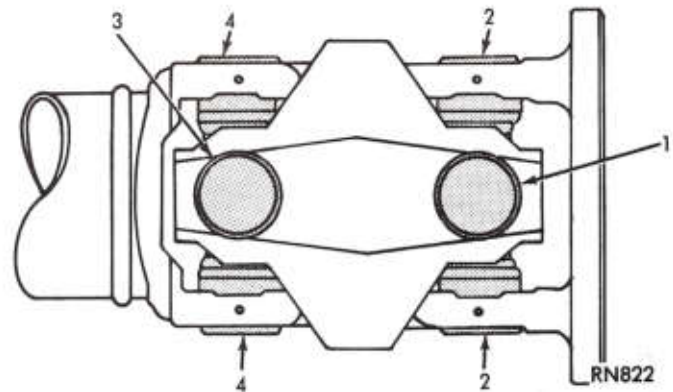


Fig. 13—Bearing Cup Removal Sequence

CONSTANT VELOCITY (CV) UNIVERSAL JOINT (Fig. 12)

Removal

Never clamp propeller shaft tubing in vise, as you may dent the tube. Always clamp on yokes. Be careful not to damage from slip yoke sealing surface. Any nicks can damage bushing or cut seal.

When flange yoke is removed, it may be necessary to remove only two bearing cups at location 1 in Figure 13. This can be determined by inspecting trunnions at location 1.

(1) Bearing cups should be removed in order indi-

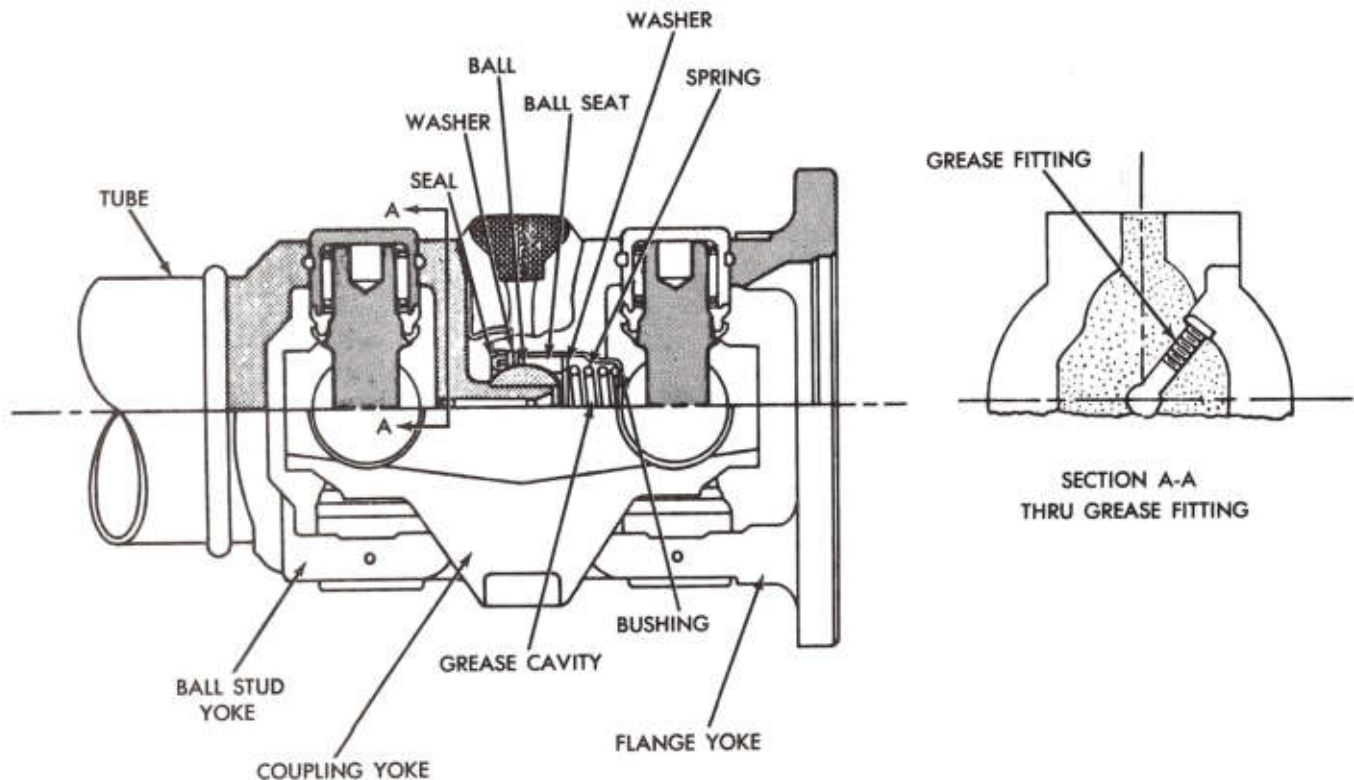


Fig. 12—Constant Velocity Universal Joint

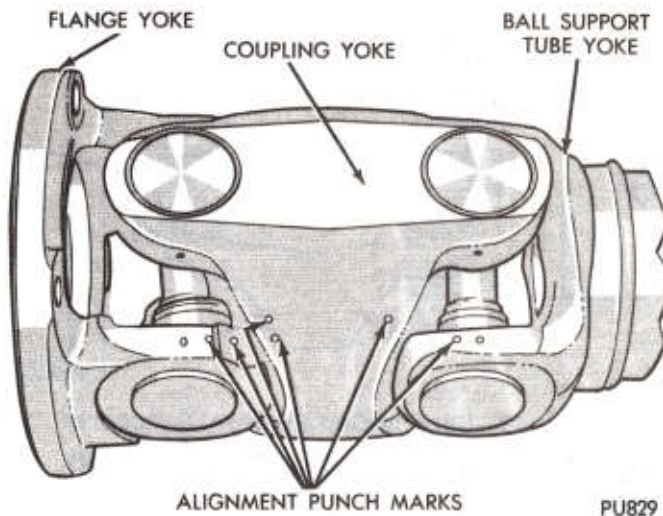


Fig. 14—Showing Alignment Punch Marks

cated in Figure 13. This method requires the least work to get to the heart of the centering ball system.

(2) Mark all yokes before disassembly so that they can be reassembled in their original relationship to retain propeller shaft balance. See Figure 14 for marking method.

(3) Support the propeller shaft horizontally in line with the base plate of a press. Place the rear ear of the coupling yoke over a 1-1/8 inch (30mm) socket. Place the cross press Tool C-4365-1, on the bearing cups in the flange yoke (Figure 15). Press the bearing cup out of the coupling yoke ear.

If the bearing cup is not completely removed, insert a C-4365-4 Spacer shown in Figure 16, and complete the removal of the bearing cup.

(4) Rotate the propeller shaft 180°. Shear the oppo-

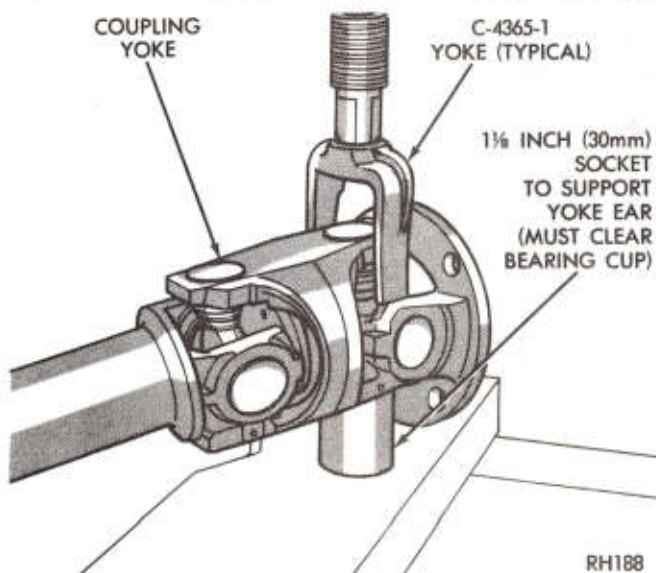


Fig. 15—Bearing Cup Removal (Tool C-4365-1)

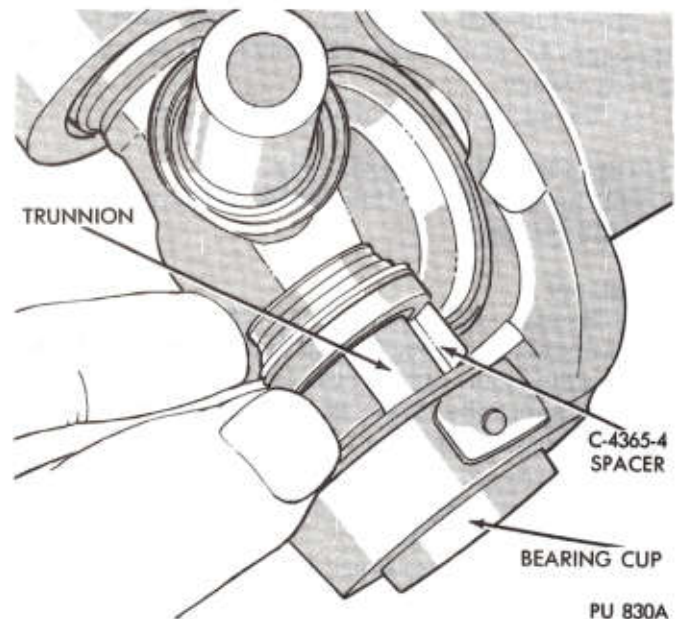


Fig. 16—Using Spacer to Remove Bearing Cup

site plastic retaining ring, and press the bearing cup out of the coupling yoke as before, using C-4365-4 Spacer.

(5) Disengage the trunnions of the cross, still attached to the flange yoke, from the coupling yoke. Pull the flange yoke and cross from the centering ball on the ball support tube yoke. The ball socket is part of the flange yoke.

(6) Pry seal from ball cavity; remove washers, spring, and three shoes as shown in Figure 17.

Ball Socket Inspection and Replacement

Removal

(1) For ball removal, separate the universal joint between the coupling yoke and the flange yoke by pressing out the trunnion bearing in the coupling yoke. Pull the flange yoke and cross with ball socket from the centering ball as a unit.

(2) Clean and inspect the ball seat insert bushing

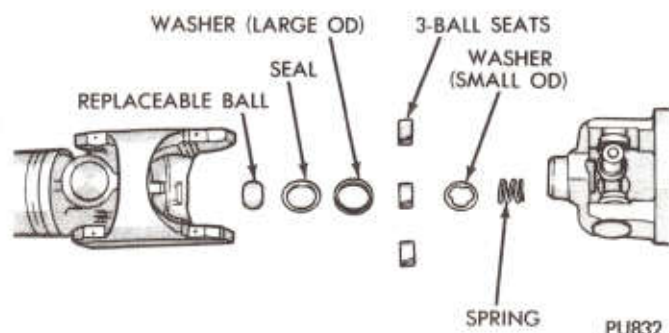


Fig. 17—Ball and Seat

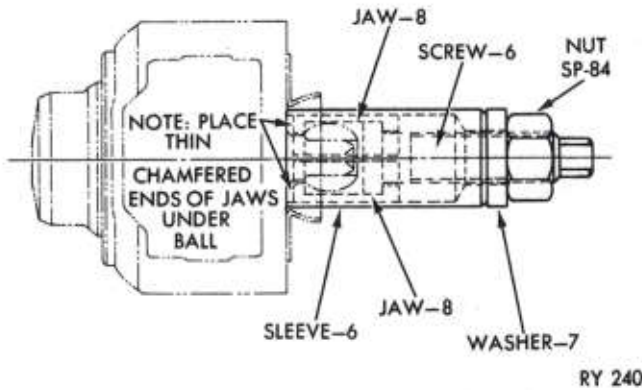


Fig. 18—Removing Centering Ball (Tool C-4365)

for wear. If bushing is worn, replace the flange yoke and cross assembly.

(3) Pry seal from ball cavity; remove washers, spring and three ball seats.

(4) Clean and inspect the centering ball surface, seal, ball seats, spring and washer. If parts are worn or broken, replacement is recommended.

(5) Remove centering ball using components of Tool C-4365; C-4365-5 screw, C-4365-6 sleeve, C-4365-7 washer, C-4365-7 nut, and C-4365-8 jaws.

(6) Draw the ball off the ball stud (Fig. 18).

Installation

(1) To install centering ball onto stud, use Tool C-4365-3 and drive until ball can be seen to seat firmly against the shoulder at the base of the stud (Fig. 19).

(2) To install cross assembly, install one bearing cup part way into one side of the yoke and turn this yoke to the bottom. Insert cross into yoke so that the trunnion seats into the bearing cup. Install the opposite bearing cup part way. Press the bearing cups, working the cross to insure free movement of the trunnions in the bearings.

(3) When one retaining ring groove clears the inside of the yoke, stop pressing and snap the retaining ring in place.

(4) Continue to press until the opposite retaining ring can be snapped into place. If difficulty is encountered, strike the yoke ear firmly with a hammer to seat the retaining rings.

(5) Relube the center ball and socket and assemble the other half of the universal joint in the same manner.

Lubrication

(1) Using the grease provided in the ball seat kit, lubricate all parts and insert them into the clean ball seat in this order: spring, small O.D. washer, three ball seats with large opening outward, and large O.D. washer.

(2) Lubricate seal lip and press in seal flush with

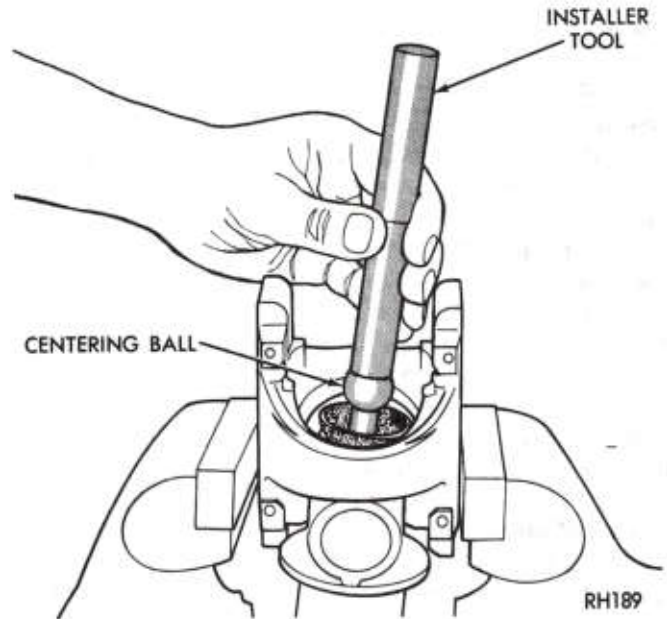


Fig. 19—Center Ball Installation (Tool C-4365-3)

suitable tool. Sealing lip should tip inward. Fill cavity with grease provided in service kit.

Installation (Front Propeller Shaft)

Propeller shaft assembly, with cross and bearings installed, must have its yoke ears at each end of the shaft on the same plane.

(1) Before installing propeller shaft, wipe sliding yoke clean, inspect machined surface for scratches, nicks or burrs. Do not burr the splines when engaging yoke splines.

(2) Provide support for propeller shaft during installation to prevent damage to universal joints.

(3) Position front end of shaft and aligning marks noted during removal.

(4) Install and attach two clamps to pinion yoke.

(5) Install four screws and lock washer assemblies on constant velocity joint at transfer case. Use press bar to prevent assembly from rotating while attaching screw assemblies.

REAR PROPELLER SHAFT

Removal

Do not disturb the retaining strap used to hold bushing assemblies on universal joint cross, if so equipped.

Do not allow propeller shaft to drop or hang loose from either joint during removal. Wire up or otherwise support the loose end of shaft to prevent damage to joint.

Before removing propeller shaft with sliding yoke from transmission, the vehicle front end should be

lowered slightly to prevent the loss of transmission fluid.

(1) Mark rear shaft and yoke to reinstall in same position.

(2) Remove both rear universal joint roller and bushing assembly clamps from rear axle drive pinion hub yoke.

(3) Slide propeller shaft with the front yoke from the transmission output shaft. Be careful not to damage splines on output shaft or yoke. Examine sliding yoke seal for evidence of leakage. If no leakage is evident, do not disturb the seal. If necessary to replace the seal, see Transmission Group 21.

Protect the machined surface of the yoke from damage after propeller shaft has been removed.

Installation

(1) Wipe propeller shaft yoke clean and inspect machined surface for scratches, nicks and deterioration. Replace or correct as necessary.

(2) Install rear universal joint cross and roller bushings in the seats of drive pinion hub yoke, aligning marks made during removal. Install bushing clamps and attaching screws.

(3) Tighten clamp screws as specified.

(4) Engage the yoke splines on end of output shaft, being careful not to burr the splines.

Universal Joint

Disassembly

(1) Hammer bushings slightly inward to relieve pressure from snap rings and remove snap rings.

(2) Position yoke in press or vise with a socket large enough to receive bushing on one side and a socket slightly smaller than bushing on the other side.

(3) With pressure applied, one roller will move into yoke and opposite roller will move into receiving socket.

(4) After one roller is out, press on cross end to move opposite roller into receiving socket.

Assembly

(1) Position yoke in vise or press with new bushing assemblies and new cross assembly.

(2) As pressure is applied, guide cross ends into bushing and roller assemblies.

(3) Press bushings just far enough in to expose snap ring grooves and install new snap rings.

(4) When second yoke is not used, install bushings with snap rings on cross ends and hold them in place with tape or wire until installation of propeller shaft.

PROPELLER SHAFT BALANCE

If a vibration is traced to the propeller shaft, it may

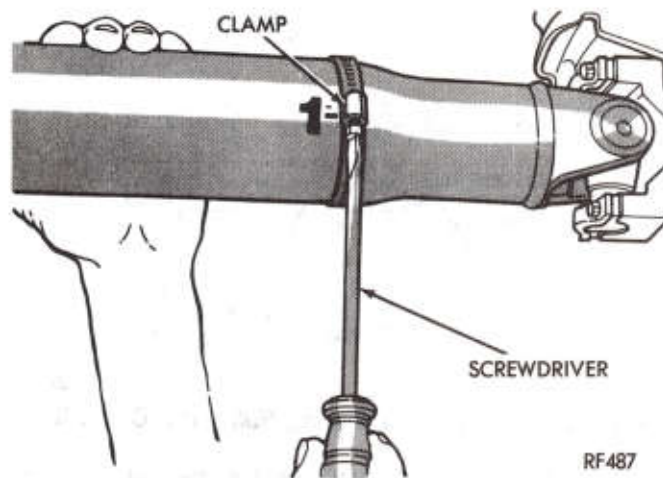


Fig. 20—Clamp Installed at Position "1"

be checked and balanced in the following manner:

(1) Raise vehicle on hoist and install jack stands.

(2) Clean all foreign material from shaft (mud undercoating, etc.).

(3) Examine shaft for missing balance weights, broken welds, bends or dents. **If the shaft is bent, it must be replaced.**

(4) Make sure that cross and rollers are not worn and that they are properly centered in the shaft and that their retainers are properly installed.

(5) Check or retighten pinion flange bolts.

(6) Remove wheel covers. Mark rear wheel and stud to aid in proper indexing at reassembly. Remove wheel and tire assemblies. Reinstall wheel nuts to hold brake drums in position.

(7) Mark the shaft at four 90° intervals, approximately six inches forward of the weld at the rear end, and number them one through four.

(8) Install and tighten a screw type hose clamp on propeller shaft with screw at position "1" (Fig. 20).

(9) Connect a tachometer. Start engine, place vehicle in gear and accelerate engine to rpm where vibration occurred. Compare vibration level to original complaint. If there is little or no change, move clamp to the other three marked positions and repeat test. If no difference is noted with clamp moved to all four positions, vibration may not be propeller shaft unbalance.

(10) If vibration lessened but was not completely gone, position two clamps at that point and run test again (Fig. 21).

(11) Two clamps combined weight at one point may cause an unbalance condition; if so, rotate clamps about 1/2 inch (1/4 inch each above and below the best position), and repeat test (Fig. 22).

(12) Continue to rotate clamps apart until vibration is at its lowest level. Bend loose end of clamp so that clamp will not loosen.

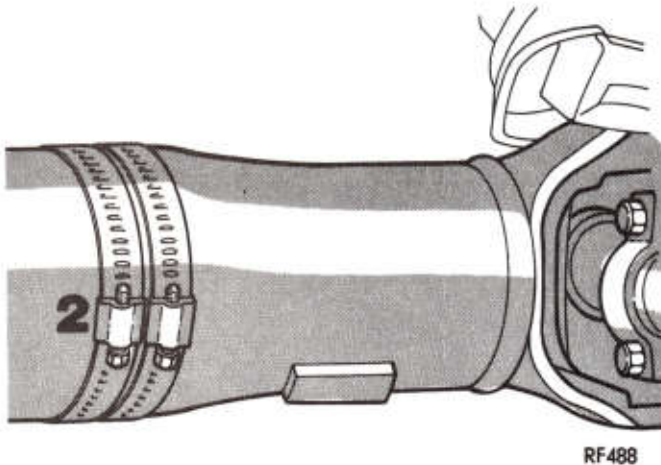


Fig. 21—Two Clamps Installed at Best Position

(13) Reinstall wheel and tire assemblies and wheel covers. Remove jack stands, lower vehicle, and road test.

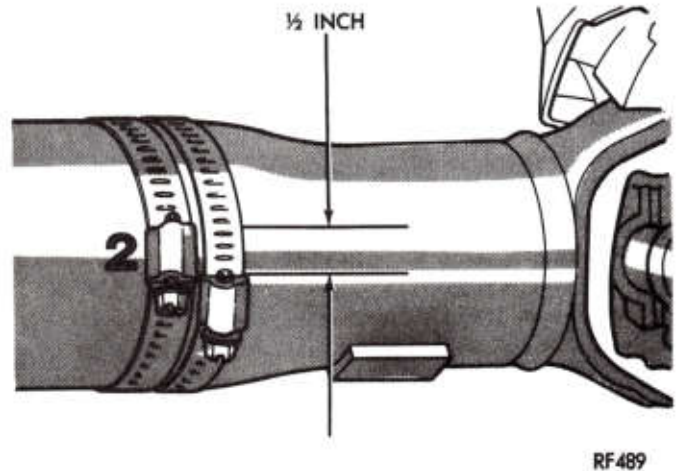


Fig. 22—Rotating Clamps Apart

(14) If vibration level is still unacceptable, repeat this procedure at the front end of propeller shaft.

TIGHTENING REFERENCE

	Thread Size	Foot Pounds	Newton meters	Inch Pounds	Newton meters
Center Bearing Bracket to Frame Bolt	7/16-14	50	68	—	—
Center Bearing Support to Bracket Bolt	7/16-14	50	68	—	—
Hub Yoke (Axle)	7/8-14	300	406	—	—
Hub Yoke (Transmission)	3/4-16	175	237	—	—
Roller Bushing Clamp Bolt	1/4-28	—	—	170	19
Roller Bushing Clamp Bolt	5/16-24	—	—	300	34
Parking Brake to Flange Yoke Nut	3/8-24	35	47	—	—
Nut to U-Bolt at Front Axle				150	17
Bolt to Constant Velocity Universal Joint at Transfer Case	7/16-14	65	88	—	—
Screw Assembly Clamp at Rear Axle				170	19
Screw Assembly Clamp at Transfer Case				170	19
Grease Fitting				30	3

SPRINGS AND SHOCK ABSORBERS

CONTENTS

	Page		Page
FRONT COIL SPRINGS (2-WHEEL DRIVE)	2	SERVICE PROCEDURES	2
FRONT LEAF SPRINGS (4-WHEEL DRIVE)	3	SHOCK ABSORBERS	6
GENERAL INFORMATION	1	TIGHTENING REFERENCE	7
REAR SPRINGS (ALL)	4	WEIGHT DISTRIBUTION AND LOADING	2

GENERAL INFORMATION

Two-wheel-drive models have an independent front suspension with coil springs operating between the front suspension crossmember and lower control arms. The shock absorbers are positioned inside the spring coil and attached to the crossmember and lower control arm (Fig. 1).

Leaf type fixed-rate front springs are used on all four-wheel-drive models.

Rear springs for all models are leaf type. Ram-charger models use a fixed rate type (Fig. 2). Progressive type rear springs (Fig. 3) are standard on all 250 and 350 models.

The progressive spring is comprised of two stages. The first stage, comprised of the upper leaves, provides a low rate at light loads. The lower leaves (second stage) gradually come in contact with the upper leaves providing increased rate at heavier

loads. This type of spring should not be confused with the main and auxiliary type of two-stage spring where the auxiliary spring is mounted above the main leaves.

The springs are designed to operate normally without lubrication between the leaves, however, under abnormal conditions, some lubrication may be necessary. Light-duty two-wheel-drive truck springs are equipped with plastic-tip liners. These tips should not be lubricated, but may be replaced if worn or missing. Heavy-duty D250 and D350 trucks do not have plastic-tip liners.

The leaf-type front and rear springs are equipped with silent block rubber bushings.

Spring leaves, if broken, may be replaced with new parts, however, if spring assemblies have taken a set (lost significant height), they should be replaced.

WEIGHT DISTRIBUTION AND LOADING

Improper load distribution can cause excessive tire wear, spring fatigue or failure, and/or erratic steering under extreme conditions. A vehicle should be loaded in such a way that the weight center line falls slightly ahead of the rear axle. Correct loading provides proper front-tire-to-road contact, thereby ensuring maximum handling stability and safety.

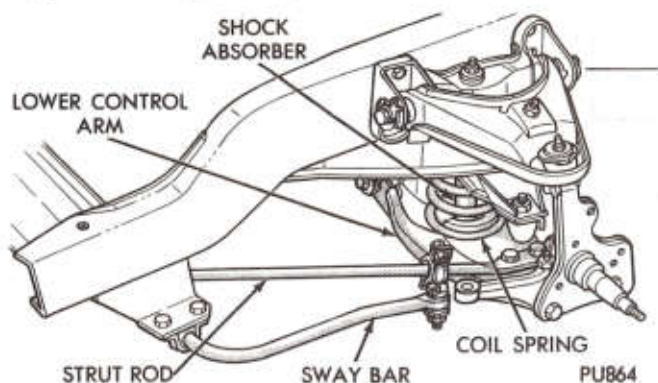


Fig. 1—Independent Front Suspension

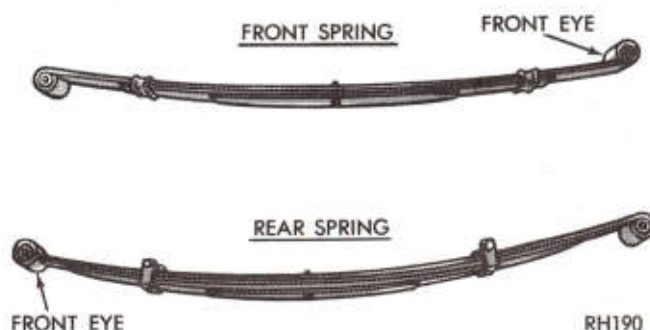


Fig. 2—Front and Rear Leaf Spring Assemblies



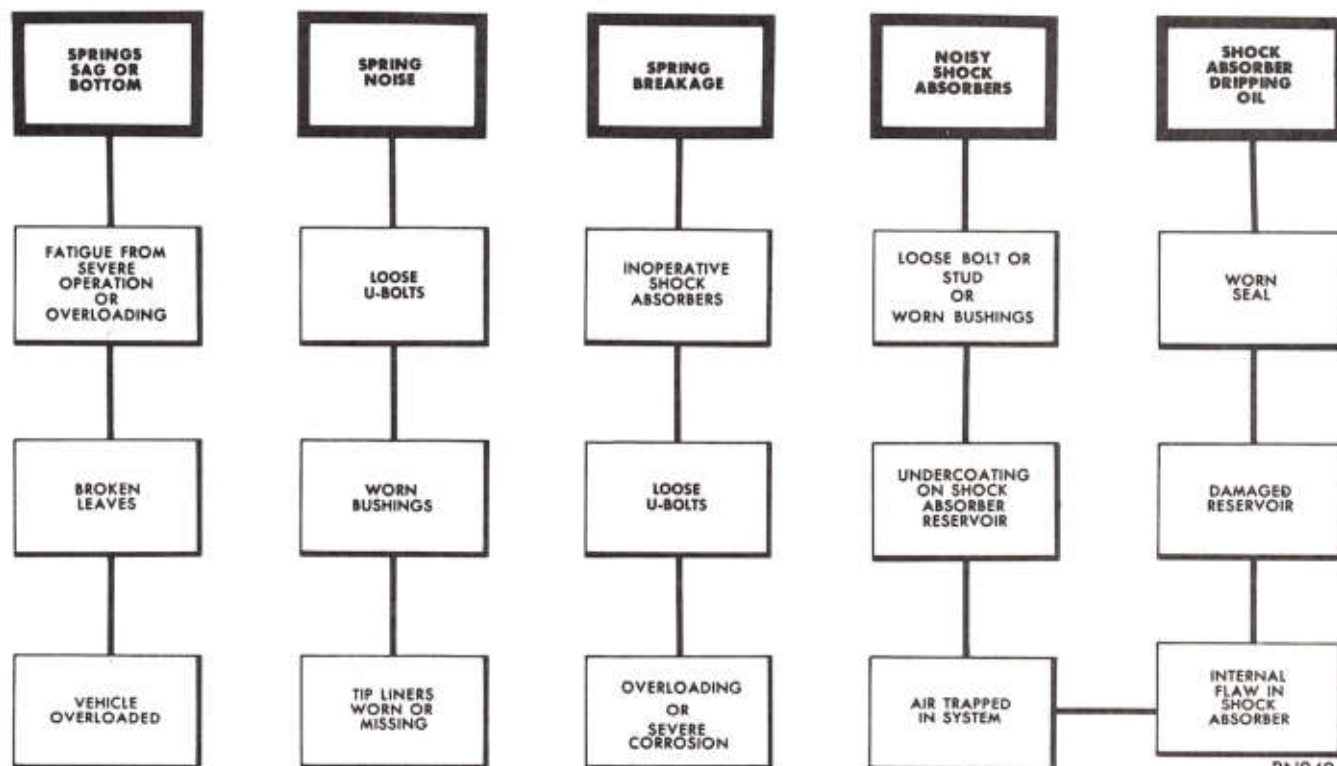
Fig. 3—Progressive Type Spring

Proper weight distribution should be considered when making inspections and adjustments to correct erratic steering, spring failure, or excessive tire wear.

SERVICE DIAGNOSIS

To use service diagnosis chart, look for the square which describes the condition requiring correction, then follow connecting lines into squares indicating possible causes.

SPRINGS AND SHOCK ABSORBERS DIAGNOSIS



RN842

SERVICE PROCEDURES

FRONT COIL SPRINGS—Fig. 4

Removal

(1) Raise the vehicle and install jack stands and lower hoist. Remove wheel and tire assembly.

(2) Remove caliper retainer. Remove caliper from disc by sliding out and away from disc. Hang caliper out of the way. **Do not let caliper hang by hydraulic hose.** Remove inboard shoe.

(3) Remove grease cap, cotter key, lock nut, adjusting nut, washer, and outer bearing.

(4) Carefully slide rotor from steering knuckle. Do not drag seal or inner bearing over steering knuckle thread, (thread, bearing, and oil seal may be damaged).

(5) Remove mounting screws and splash shield.

(6) Remove shock absorber upper nut and retainer, and two lower mounting bolts. Remove shock absorber and upper shock absorber bushing and sleeve.

(7) Remove spring pin from strut (bushing end). Loosen retaining nut.

(8) Install spring compressor Tool DD-1278, tighten finger tight then back off 1/2 turn (Fig. 5).

(9) Remove cotter keys and ball joint nuts.

(10) Install ball joint breaker Tool C-3564-A, turn threaded portion of tool, locking securely against lower stud (Fig. 5). Spread tool enough to place lower stud under pressure then strike steering knuckle sharply with a hammer to loosen stud. **Do not attempt to force stud out of knuckle with tool alone.**

(11) Remove ball joint breaker tool. Slowly loosen coil spring compressor until all tension is relieved from spring. Remove spring compressor and spring.

Installation

(1) Position spring on control arm, install spring compressor. Compress spring until ball joint is properly positioned on steering knuckle.

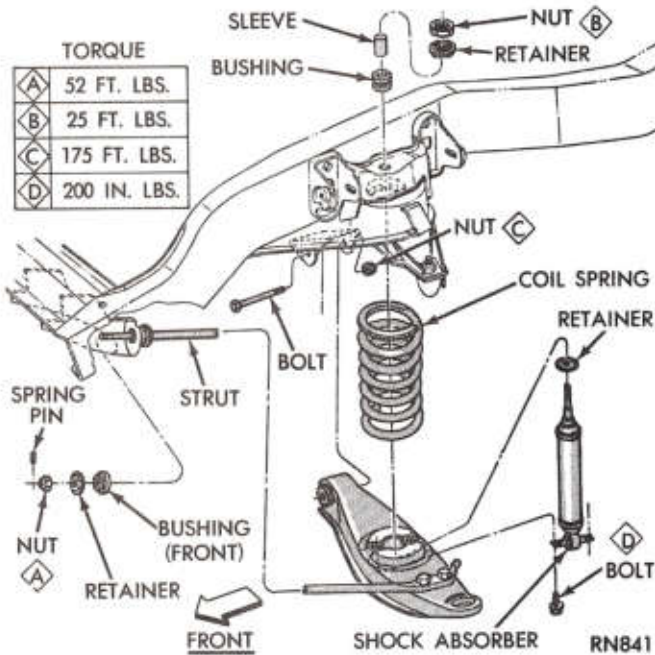


Fig. 4—Spring and Shock Absorber (Independent Front Suspension)

- (2) Install ball joint nuts, tighten to 175 ft. lbs. (237 N-m). Install cotter keys.
- (3) Tighten bushing retainer nut (front end of strut) to 50 ft. lbs. (70 N-m) and install spring pin.
- (4) Connect sway bar (if so equipped), and tighten

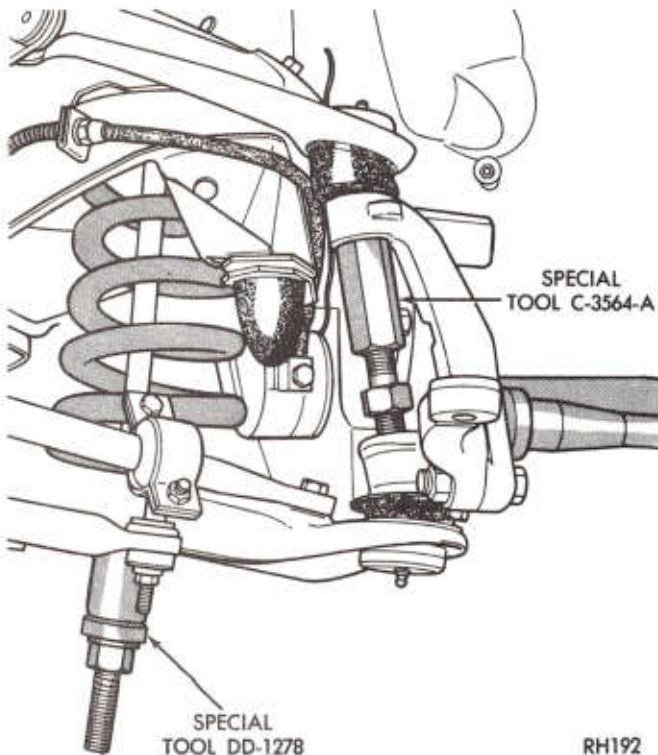


Fig. 5—Ball Joint Breaker and Spring Compressor Tools Installed

link to 100 in. lbs. (11 N-m). Remove spring compressor tool.

(5) Install upper shock absorber bushing and sleeve. Position shock absorber and install upper retainer and nut and tighten to 25 ft. lbs. (34 N-m). Install lower mounting bolts and tighten to 200 in. lbs. (23 N-m).

(6) Position brake splash shield on steering knuckle and install and tighten mounting screws to 200 in. lbs. (23 N-m).

(7) Carefully install rotor assembly onto steering knuckle followed by outer bearing, washer and nut. Tighten adjusting nut to 35 ft. lbs. (48 N-m) while rotating rotor. Stop rotation and back off the adjusting nut to completely release bearing preload. Next finger tighten adjusting nut and install lock nut and cotter key. The resulting adjustment should be .0001 to .003 inch (.0025 to 0.76mm) end play. Clean grease cap and lightly coat inside with wheel bearing lubricant and install.

(8) Locate inboard shoe on adaptor with shoe fingers in adaptor ways. Slowly slide caliper assembly into position in adaptor and over rotor. Align caliper on machined ways of adaptor. **Be careful not to pull the dust boot from its grooves as the piston and boot slide over the inboard shoe.**

(9) Install retaining clips and torque retainer screws to 180 in. lbs. (20 N-m). **The inboard shoe anti-rattle spring must always be installed on top of the retainer spring plate.**

(10) Install and tighten wheel and tire assembly.

(11) Raise hoist, remove jack stands, lower vehicle and test vehicle operation.

FRONT LEAF SPRINGS—Figs. 6 and 7

Removal

- (1) Using a chain hoist or hydraulic crane hooked to towing eyes or at frame attachment, raise truck until weight is removed from springs.
- (2) With wheels still touching the floor, install stands under side frame members as a safety precaution.
- (3) Remove nuts, lockwashers, and U-bolts securing spring to axle.
- (4) Remove spring shackle bolts, shackles, and spring front eye bolt, then remove spring.

Installation

- (1) Line up spring fixed eye with bolt hole in bracket and install spring bolt and nut.
- (2) Install shackle bolts, shackles and nuts. Tighten shackle bolt nuts and fixed eye bolt nut until slack is taken up.
- (3) Position spring on axle so spring center bolt enters locating hole in axle pad.
- (4) Install U-bolts, new lockwashers and nuts.

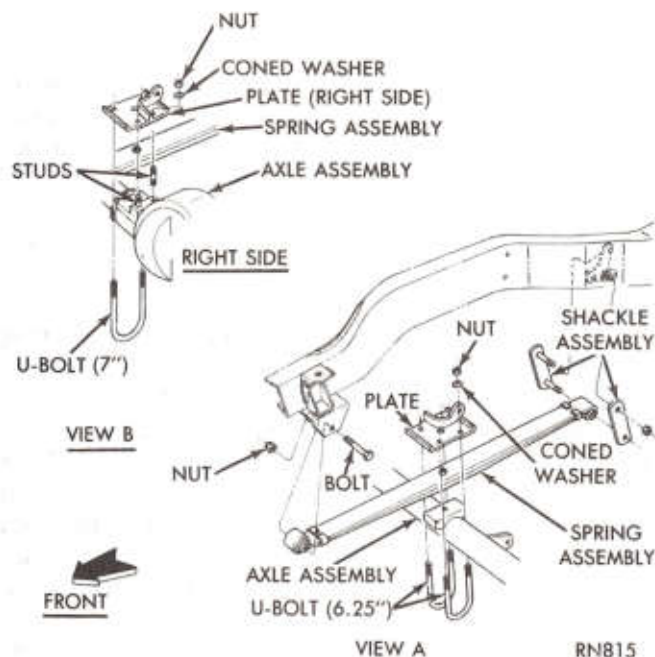


Fig. 6—Front Suspension (Spicer 44 Axle) W150, W250, W350, and AW150

Tighten until nuts push lockwashers against axle.

(5) Remove stands from under frame, lower truck so weight is resting on wheels. Tighten U-bolt nuts, spring eye bolt nuts, and shackle bolt nuts to specifications given in spring tightening references.

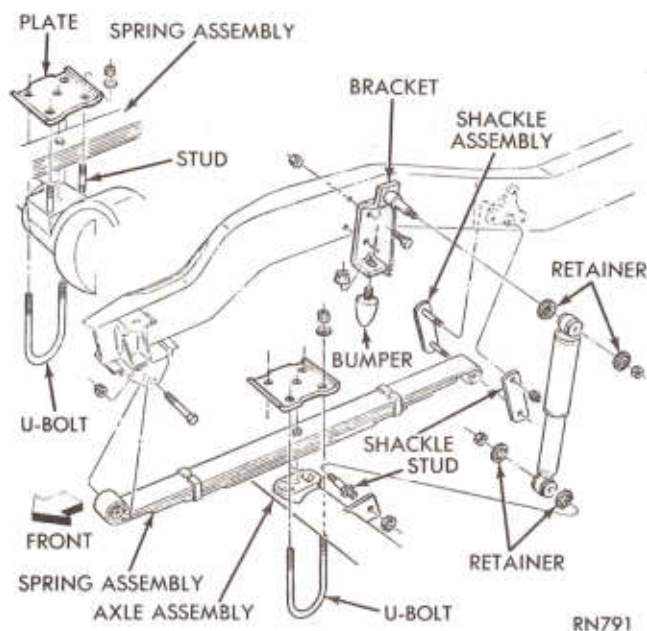


Fig. 7—Front Suspension (Spicer 60 Axle) W350

REAR SPRINGS (Figs. 8, 9 and 10)

Removal

(1) Raise rear of truck with chain hoist or hydraulic crane until weight is removed from springs, wheels just touching the floor.

Truck must be lifted by jack or hoist under frame side rail at crossmember behind the axle, being careful not to bend flange of side rail.

(2) Place stands under side frame members as a safety precaution.

(3) Remove nuts, lockwashers and U-bolts securing spring to axle.

(4) Remove spring shackle bolts, shackle, and spring front bolt, then remove spring.

Installation

(1) Position spring on axle so spring center bolt enters locating hole in axle housing pad.

(2) Line up spring front eye with bolt hole in bracket and install spring bolt and nut.

(3) Install the rear shackle, bolts and nuts. Tighten shackle bolt nuts and front bolt nut until slack is taken up.

(4) Install U-bolts, new lockwashers and nuts. Tighten until nuts push lockwashers against axle. Align auxiliary spring parallel with main spring.

(5) Remove stands from under frame, lower truck so weight is resting on wheels. Tighten the U-bolt nuts, spring eye bolt nuts and shackle bolt nuts to specifications given in spring tightening reference.

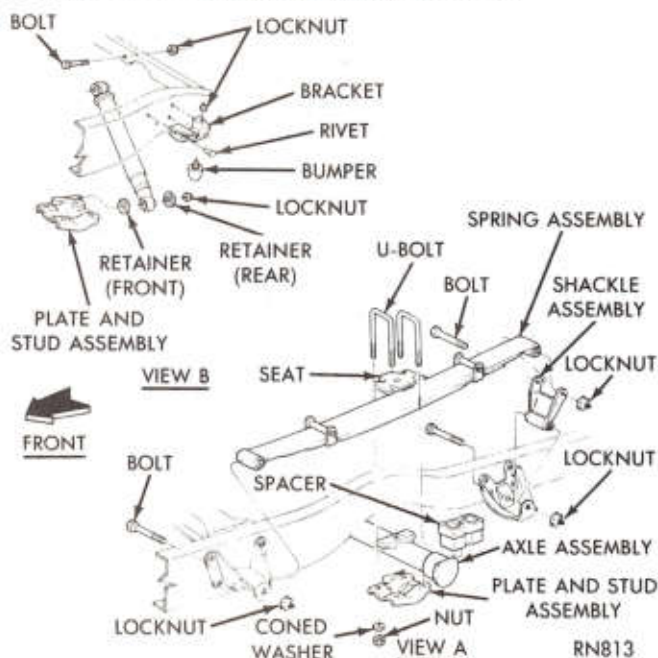


Fig. 8—Rear Suspension, 150 Models

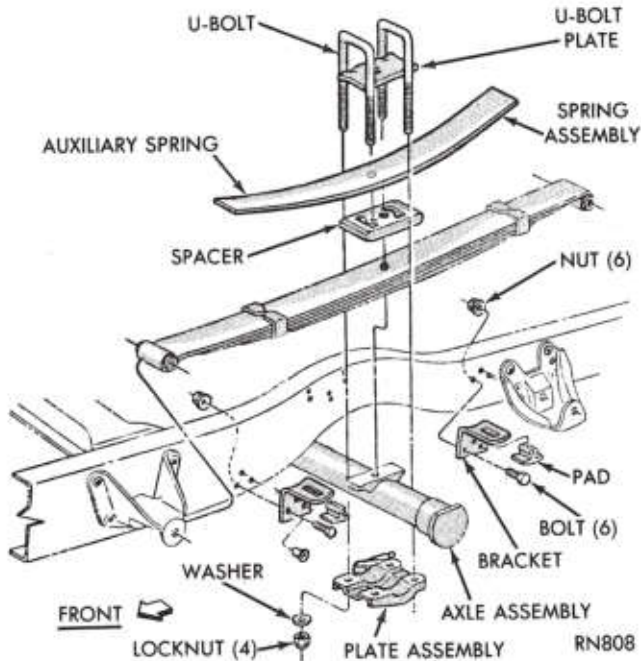


Fig. 9—Rear Suspension with Auxiliary Spring, D150

Installing New Leaf

- (1) Clamp spring in a vise as shown in Figure 11.
- (2) Insert long drift in center bolt hole and release vise slowly.
- (3) Remove assembly from vise and replace broken leaf.
- (4) Place spring assembly in vise, slowly tighten vise while holding spring leaves in alignment with drift.

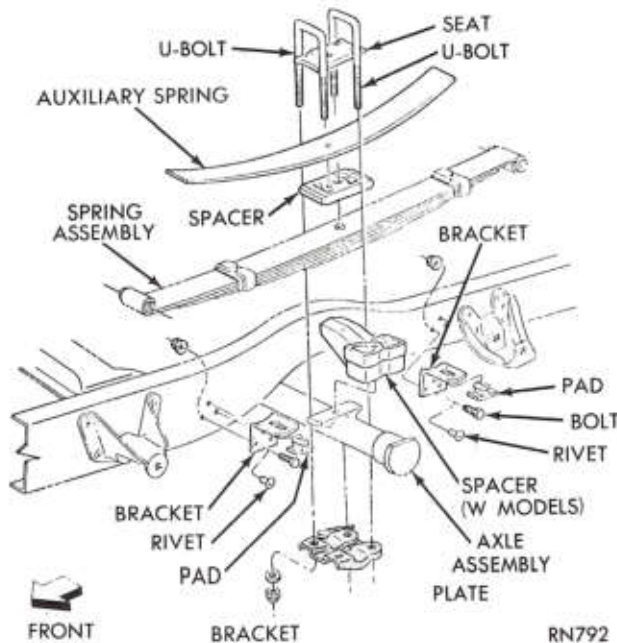


Fig. 10—Rear Suspension with Auxiliary Spring D and W250, W350

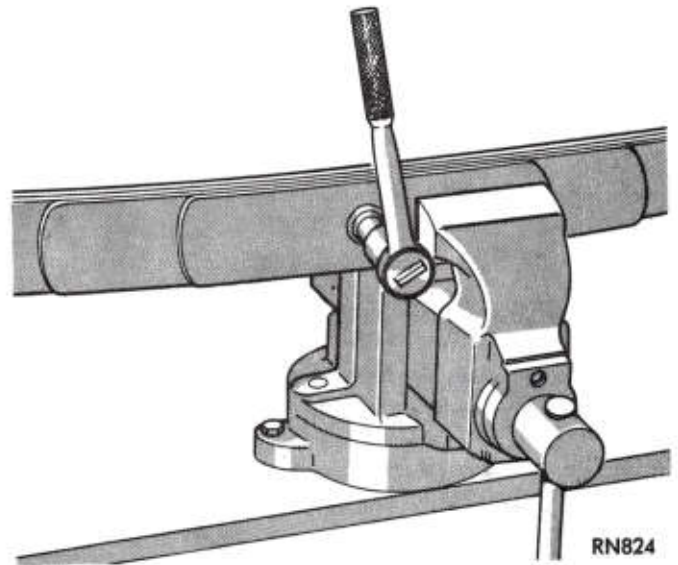


Fig. 11—Disassemble Spring Assembly

- (5) Remove drift and install new center bolt (Fig. 11).
- (6) Install nut, tighten to 15 ft. lbs. (20 N·m) or until center of spring has no gap between leaves (maximum 40 ft. lbs. (54 N·m)). Reinstall alignment clips.

SWAY BAR (Figs. 12 and 13)

Removal

- (1) Remove link rod nut from each end of sway bar.
- (2) Remove retainers and rubber bushings from sway bar link rods.

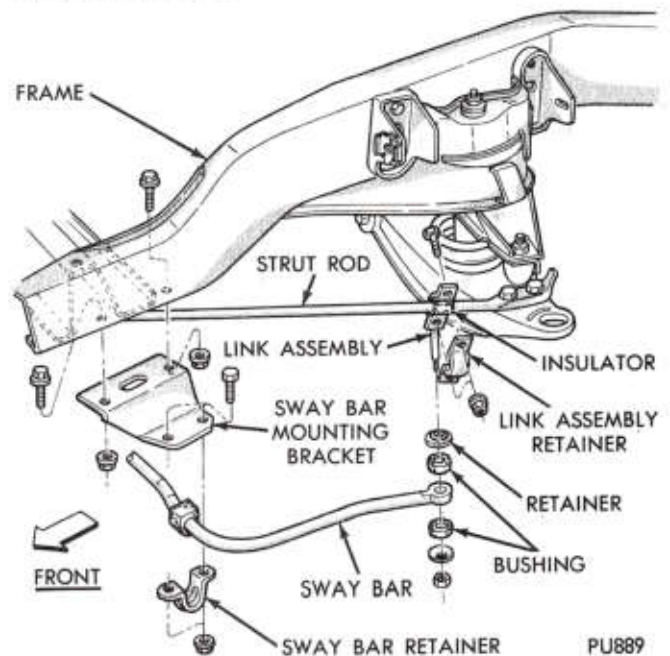


Fig. 12—Sway Bar, Independent Front Suspension

(3) Remove bolts from U-shaped sway bar support brackets and remove sway bar.

Installation

(1) Place sway bar into position and install the U-shaped sway bar support brackets. Tighten as specified.

(2) Install sway bar link retainers and bushings.

(3) Install link rod nuts. Tighten as specified.

SHOCK ABSORBERS (Figs. 4, 7, 8, and 14)

Shock Absorber Removal and Installation

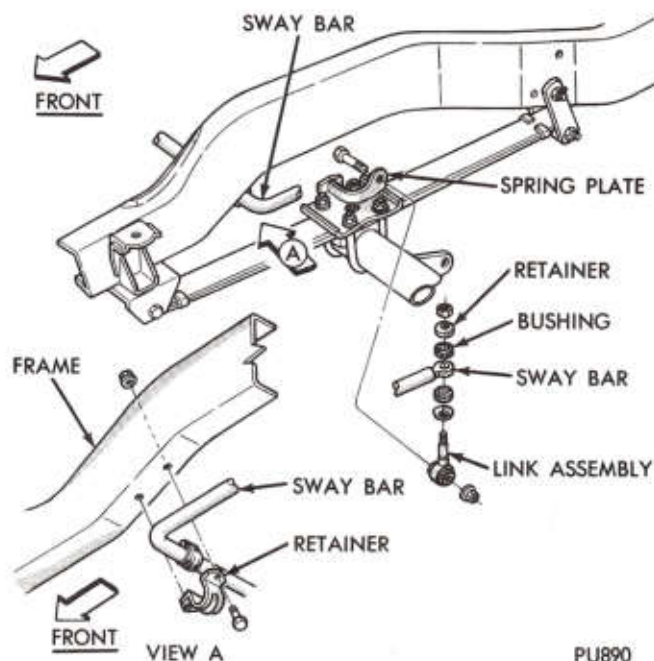
(1) Remove two bolts securing shock absorber bracket to the frame. **On all 4WD Models, remove lower bracket bolt, loosen upper bolt, rotate bracket until shock absorber clears upper bolt and remove.**

(2) Remove shock absorber lower bracket nut, rubber bushings and washers.

(3) After removing shock absorber and bracket assembly from vehicle, remove bracket from shock absorber.

(4) Before installing the shock absorbers on the vehicle, install upper brackets.

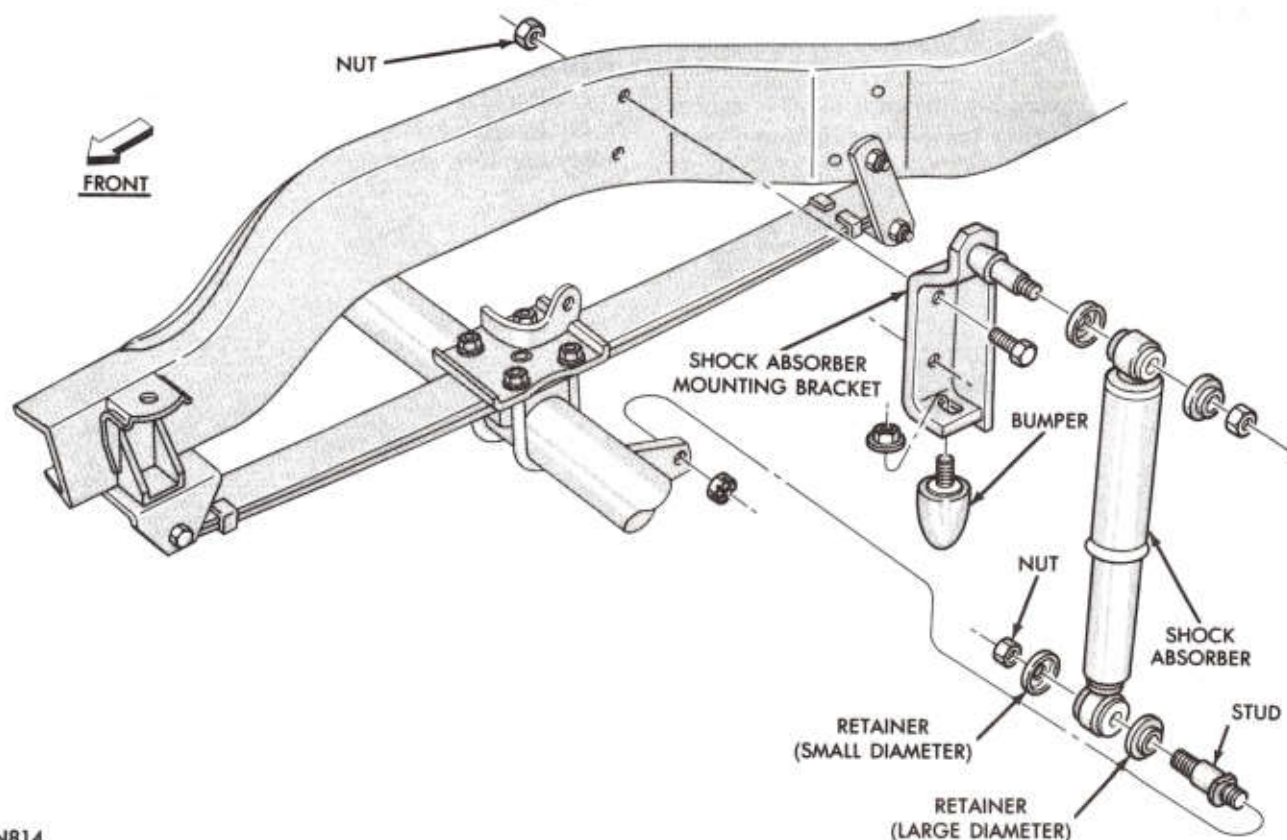
(5) When installing the shock absorbers, be sure the bushings are replaced in the shock absorber and the shock absorber assembled to the stud with proper



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Fig. 13—Sway Bar, 4WD Models

retainers on either side of the bushings. Install the nut and tighten as specified in tightening reference.



RN814

Fig. 14—Front Suspension Shock Absorber and Bumper (AW150)

Shock Absorber Tests

- (1) Remove shock absorber from vehicle.
- (2) To remove entrapped air use the following procedure:
 - a. Hold shock upright (simulate position as on vehicle) and run to full extension.
 - b. Invert shock absorber and slowly collapse until the piston bottoms.

- c. Repeat the above procedure several times.
- (3) Clamp lower end in vise having shock absorber in upright position.
- (4) Extend and collapse shock absorber.
- (5) A good shock absorber will have an even, steady resistance in both directions.
- (6) If little or no resistance is felt, the shock absorber should be replaced.

TIGHTENING REFERENCE

	Foot Pounds	Inch Pounds	Newton-Meters
SPRINGS (FRONT)			
Shackle Bolt Nut and Front Eye Bolt (1/2-20)	80		108
Spring Plate Studs (Spicer 60)	115		156
Spring Plate Studs (Spicer 44)	105		142
Spring Plate Stud Nuts (9/16-18)	95		129
U-Bolt Nuts (9/16-18)	95		129
SPRINGS (REAR)			
Shackle Bolt Nut and Front Eye Bolt (1/2-20)	95		129
Shackle Bolt Nut and Front Eye Bolt (5/8-18)	125		169
Shackle Bolt Nut and Front Eye Bolt (3/4-16)	155		210
U-Bolt Nuts (1/2-20)	65		88
U-Bolt Nuts (9/16-18)	110		149
Aux. Spring Pad Bracket to Frame Nut (3/8-16)	30		41
SHOCK ABSORBERS (FRONT)			
Independent Front Suspension Models			
Upper Bushing Retaining Nut (3/8-24)	25		34
Lower Mounting Nuts (5/16-18)	—	200	23
Four-Wheel-Drive Models			
Lower Shock Absorber Mounting Stud to Axle Nut (3/4-16)	115		156
Lower Shock Absorber Mounting Nut (1/2-20)	55		75
Upper Shock Absorber Mounting Nut (1/2-20)	55		75
SHOCK ABSORBERS (REAR)			
Lower Mounting Nut (1/2-20)	60		81
Upper Mounting Nut (1/2-20)	60		81
JOINT BUMPERS			
Front Joint Bumper Retaining Nut	30		41
Front Joint Bumper Mounting Bracket to Frame Nuts (1/2-13)	75		102
D150, W150, and Sport Utility			
Rear Joint Bumper Retaining Nut	—	180	20
Rear Joint Bumper Mounting Bracket to Frame Nuts (3/8-16)	30		41
D and W250 and 350 Models			
Rear Joint Bumper Retaining Nut	—	200	23
SWAY BAR			
Independent Front Suspension Models			
Link Assembly to Front Strut Rod Mounting Nuts (5/16-18)	—	200	23
Sway Bar Mounting Bracket to Frame Nuts (7/16-14) U-Shaped Retainer to Mounting Bracket Nuts (5/16-18)	50		68
Sway Bar to Link Assembly Nut (5/16-18)	—	200	23
Four-Wheel-Drive Models		100	11
U-Shaped Retainer to Frame Nuts (5/16-18)	75		102
Link Assembly to Spring Plate Mounting Nut (1/2-13)	75		102
Sway Bar to Link Assembly Nut (5/16-18)	—	100	11
UPPER CONTROL ARM			
Camber/Caster Adjusting Cam Nuts	70		95
Upper Ball Joint to Steering Knuckle Nut	135		183

17-8 TIGHTENING REFERENCE

LOWER CONTROL ARM

Lower Control Arm to Frame Pivot

	Foot Pounds	Newton-Meters
Bolt Nut (5/8-18 & 3/4-16)	175	237

Lower Ball Joint to Steering Arm Nut	175	237
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Strut Rod to Lower Control Arm Nuts (1/2-13)	100	136
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Strut Rod Front Mounting Nut	52	70
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STEERING KNUCKLE

Steering Knuckle to Steering Arm Mounting Nuts	225	305
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STEERING

CONTENTS

	Page		Page
MANUAL STEERING GEAR	1	STEERING COLUMNS—STANDARD	26
POWER STEERING GEAR	7	STEERING COLUMNS—TILT-WHEEL	34
POWER STEERING PUMP	19	TIGHTENING REFERENCE	40
SPECIFICATIONS	40		

MANUAL STEERING GEAR

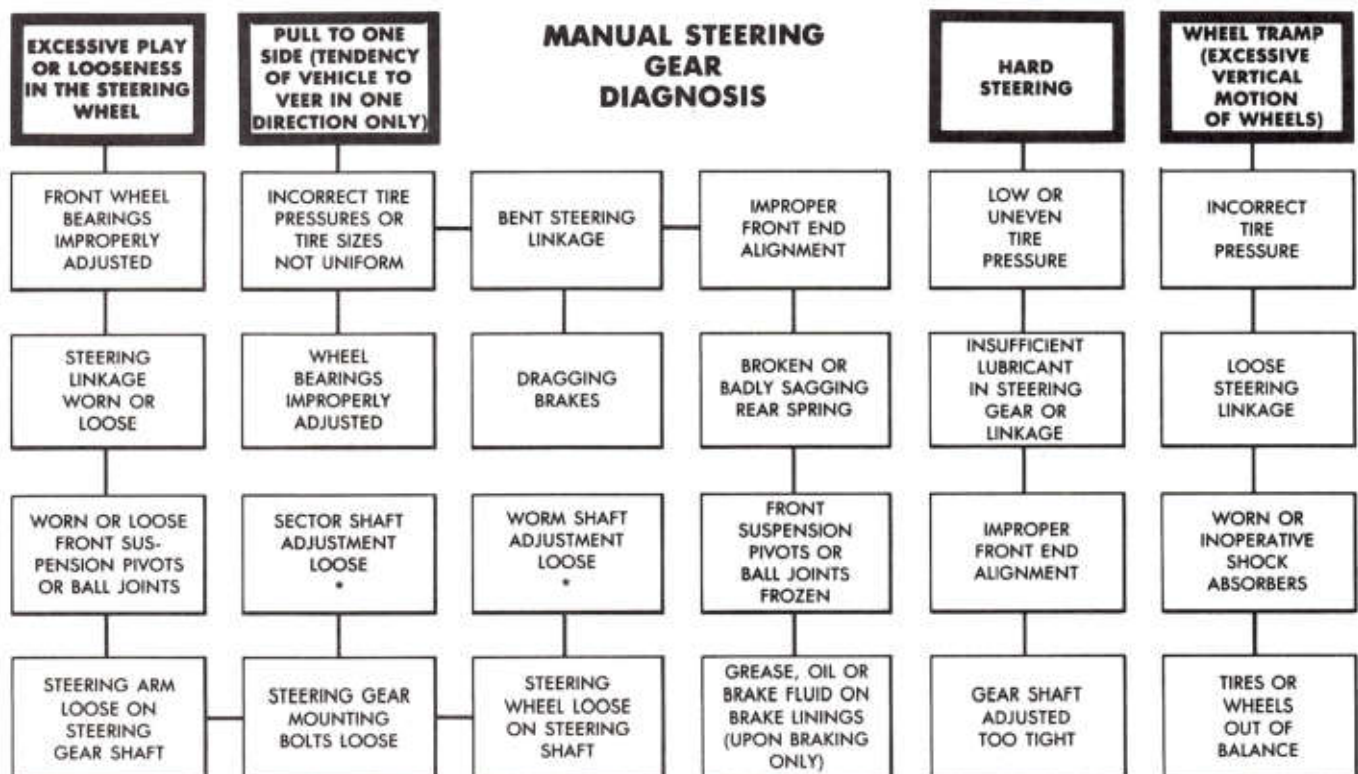
INDEX

	Page		Page
Adjustments		Sector Shaft Bushing Replacement—Side Cover	4
Ball Nut Rack and Sector Mesh	2	Wormshaft Bearing—Adjuster Race Replacement	4
Worm Bearing Preload	2	Wormshaft Bearing Race Replacement—Housing	4
Ball Nut		Removal and Disassembly	
Side Loading Guides	4	Disassembly	3
Top Loading Guides	5	Removal	3
General Information	1	Specifications	40
Reassembly and Installation		Tightening Reference	40
Installation	7		
Reassembly	5		
Recondition Gear			
Sector Shaft Bushing Replacement—Housing ..	4		

GENERAL INFORMATION

Safety goggles should be worn at all times when working on any steering gear.

The manual steering gear (Fig. 1) is designed to provide easy steering with minimum friction in the



* TESTS, ADJUSTMENTS AND PROCEDURES ARE DESCRIBED IN THIS MANUAL

RN817

steering gear. A ball nut travels up or down on the wormshaft, riding on recirculating balls which act as a screw thread.

The wormshaft and ball nut assembly is supported in the gear housing by an adjustable ball thrust type upper and lower bearing.

The sector shaft is integral with the sector gear. The sector gear meshes with the rack teeth on the recirculating ball nut. Adjustment at this point is controlled by the sector shaft adjusting screw which extends through the housing cover.

The teeth on the sector, and the ball nut are so designed that a tighter fit exists between the two when the front wheels are straight ahead. Proper

engagement between the sector and the ball nut is obtained by an adjusting screw which moves the sector shaft endwise, permitting desired engagement of the tapered teeth of the ball nut and sector gear. The worm bearing adjuster can be turned to provide proper preloading of the upper and lower worm thrust bearings.

To use Steering Service Diagnosis chart, look for the squares with heavy lines which describe the condition requiring correction, then follow connecting lines into squares indicating possible causes. In most cases corrective procedures are self-evident, however, an asterisk (*) indicates a procedure described in appropriate section of this manual.

SERVICE PROCEDURES

ADJUSTMENTS

Two adjustments are provided in the steering gear (Figs. 1 & 2). The worm bearing preload adjustment, and the ball nut rack sector gear mesh adjustment.

Before the correct adjustment can be made at the ball nut rack and the sector gear, it must be determined that the worm bearing preload is properly adjusted.

The worm bearing preload adjustment is controlled by the worm thrust bearing adjuster which threads into the housing at the lower end of the wormshaft.

Worm Bearing Preload

(1) Disconnect and remove steering gear arm from sector shaft using Tool C-4150 (Fig. 3).

(2) Remove horn pad.

(3) Loosen sector shaft adjusting screw locknut, and back out adjusting screw 1/2 to 2 turns. This will relieve any friction load which may be present at the

closely meshed ball nut rack and sector gear teeth.

(4) Turn steering wheel to right stop then back it off 1/2 turn and place Tool C-3380 or other suitable torque wrench on steering shaft nut.

(5) Rotate steering shaft from right stop toward straight ahead position, while testing rotating torque with torque wrench.

The torque required to keep wheel moving should be between 4 and 6 in. lbs. If reading is not within these limits, adjustment can be made, in or out of the vehicle as follows:

(a) Loosen adjuster locknut.

(b) Turn adjuster plug clockwise to increase preload or counterclockwise to decrease preload.

(c) While holding adjuster plug from turning, tighten locknut securely, then retest worm bearing preload.

Ball Nut Rack and Sector Mesh

The sector shaft adjusting screw, located in housing

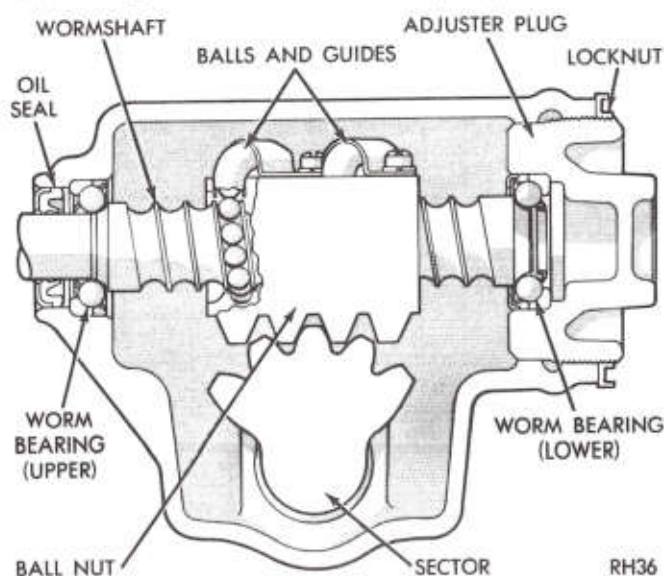


Fig. 1—Manual Steering Gear

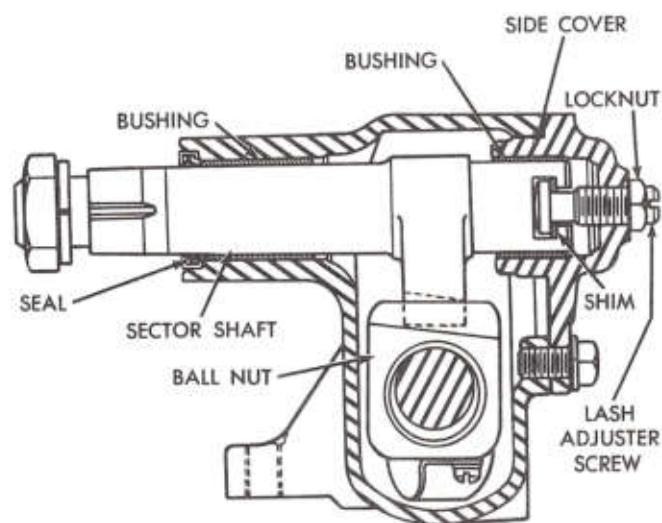


Fig. 2—Manual Steering Gear

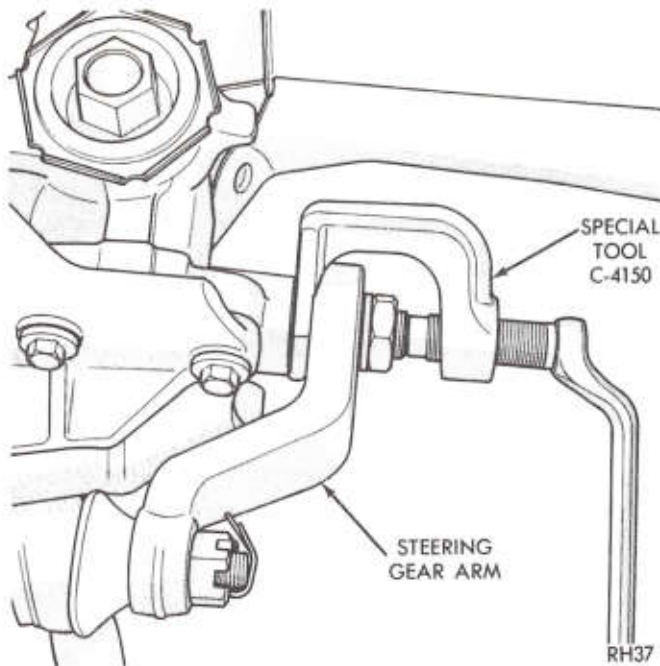


Fig. 3—Remove Steering Gear Arm

cover, raises or lowers shaft to provide proper mesh load between tapered teeth of sector gear and tapered teeth of ball nut. **This adjustment can be accurately made only after proper worm bearing preload has been established.**

(1) Turn steering wheel gently from one stop to the other, carefully counting number of turns. Turn steering wheel back exactly half way, to center position.

(2) Turn sector shaft adjusting screw clockwise to take out all lash between ball nut rack and sector gear teeth, then tighten adjusting screw locknut as specified.

(3) Turn steering wheel about 1/4 turn away from center of "high spot" position. Then, using torque wrench at steering wheel nut, measure torque required to rotate steering wheel through high spot at center position. The reading should be 14 in. lbs. This represents the total of worm shaft bearing preload and ball nut rack and sector gear-mesh load. Readjust sector shaft adjustment screw if necessary, to obtain proper torque reading.

(4) After adjustments have been completed, place front wheels in a straight ahead position, and with steering gear and steering wheel centered, install steering arm lockwasher and nut on sector shaft.

(5) Tighten steering arm retaining nut to 175 ft. lbs. (237 N·m).

REMOVAL AND DISASSEMBLY

Removal

- (1) Remove two bolts from wormshaft coupling.
- (2) Remove steering arm from steering gear using

Tool C-4150 (Fig. 3).

(3) Remove steering gear to frame bolts and remove gear from vehicle.

Disassembly

Thoroughly clean entire outside surface of steering gear before disassembly to avoid contaminating wormshaft and ball nut assembly with dirt or grit.

(1) Attach steering gear to holding fixture Tool C-3323 and install holding fixture in a vise. If fixture is unavailable, clamp vise jaw on mounting lug.

(2) Rotate wormshaft from stop to stop, counting the turns, then turn back exactly half way, placing it on center.

(3) Loosen sector shaft adjuster screw locknut and remove cover to housing bolts.

(4) Lift the side cover and sector shaft assembly from the gear housing. Using a plastic hammer, tap lightly on the end of the sector shaft to aid in removal (Fig. 4).

(5) Loosen wormshaft bearing adjuster locknut and remove wormshaft bearing adjuster assembly including one bearing and one race.

(6) Remove the wormshaft and ball nut assembly from the housing (Fig. 5).

CAUTION: Be careful that the ball nut does not run down to either end of the wormshaft as the ball guide ends can be damaged if the ball nut is allowed to rotate until stopped at the end of the worm.

(7) Remove the remaining wormshaft bearing from inside the gear housing.

(8) Using a screwdriver, pry the lower bearing retainer from the adjuster plug, and remove the bearing (Fig. 6).

(9) Remove locknut from sector shaft adjusting screw and remove screw from cover by turning screw clockwise. Slide the adjuster screw and shim out of the slot in the end of the sector shaft.

(10) Remove wormshaft and sector shaft seals.

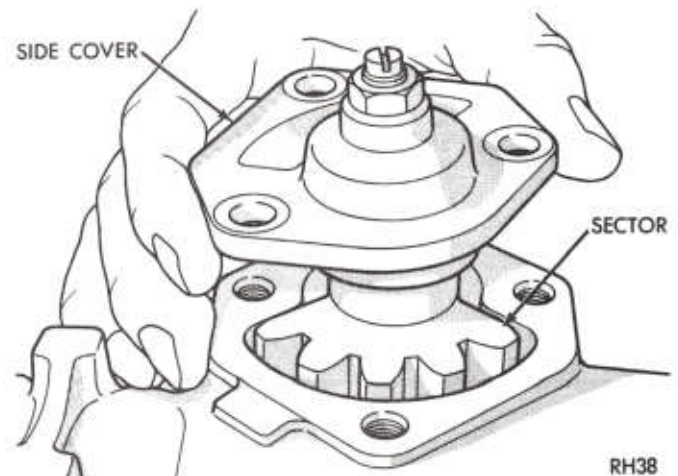


Fig. 4—Remove Sector Shaft Assembly

Cleaning and Inspection

Having disassembled the steering gear completely, make sure all parts are clean. Wash parts in cleaning solvent and dry thoroughly with compressed air. Check bearings and bearing races for signs of defects, such as cracks, surface imperfections and distorted cage. Replace parts having defects.

RECONDITION GEAR

Sector Shaft Bushing Replacement—Side Cover

Check sector shaft and bushing for wear. If clearance resulting from bushing wear is excessive, replace the entire side cover and bushing assembly.

Sector Shaft Bushing Replacement—Housing

(1) Support the steering gear housing in an arbor press; press the sector shaft bushing and seal from the housing using Tool C-4171 and Adapter C-4173 inserted from the lower end of the housing.

(2) Press the new bushing into position using Tool C-4171 and Adapter C-4174. No reaming is necessary after installation, as service bushings are machined to size. Install seal using suitable tool.

Install a new seal whenever a seal has been removed, or if signs of wear are evident.

Wormshaft Bearing—Adjuster Race Replacement

(1) Hold wormshaft adjuster in vise. Using slide hammer Tool C-637 or other suitable tool, remove bearing race.

(2) Press the new bearing race into position using Tool C-4171 and Adapter C-4176.

Wormshaft Bearing Race Replacement—Housing

(1) Drive the bearing race out of the housing with the aid of a drift or punch.

(2) Press the new bearing race into position using

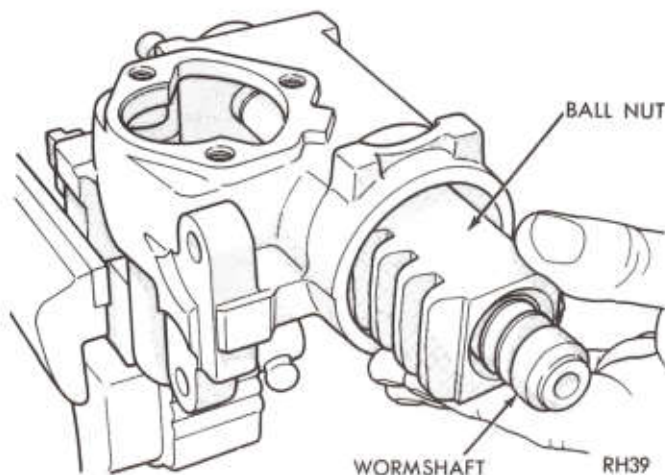


Fig. 5—Remove Ball Nut and Wormshaft

Tool C-4171 and Adapter C-4176.

BALL NUT

Side Loading Guides

If there is no indication of binding or tightness in the ball bearing nut assembly when the wormshaft is rotated, disassembling the unit is unnecessary. If, however, tightness or binding is noticed, disassemble, clean and inspect the unit to determine the cause. Disassemble the ball nut, clean and inspect as follows:

(1) Remove screws and ball retaining clamp. Remove guides from nut.

(2) Invert the nut, rotate wormshaft in both directions to permit the balls to drop out. Make sure work area is clean. Having removed all of the balls, remove the nut from the wormshaft.

(3) Wash parts, using cleaning solvent and dry with compressed air. Using a magnifying glass, inspect parts for defects. Check the ball guide ends for damage. Replace defective parts.

(4) Hold the ball nut with the helical grooved bore in a horizontal position and the ball guide holes up. Have the shallow side of the rack teeth toward the left as viewed from the steering wheel related end. Insert the wormshaft, aligning the wormshaft grooves with the grooves in the nut.

(5) Count 27 balls, number of balls for one circuit, into a clean container. Place 20 of these balls into one of the guide holes. It may be necessary to push them in with the aid of a pin punch (Fig. 7).

CAUTION: Do not rotate wormshaft while installing the balls, or until both circuits complete with balls are assembled.

(6) Place one set of ball guides on the bench, each guide-half having the ballgroove up. Position the remaining seven balls into the groove of one ball guide-half and cover them with the second guide-half. Holding the two halves together, plug the opening in each end with a dab of grease to keep the balls in

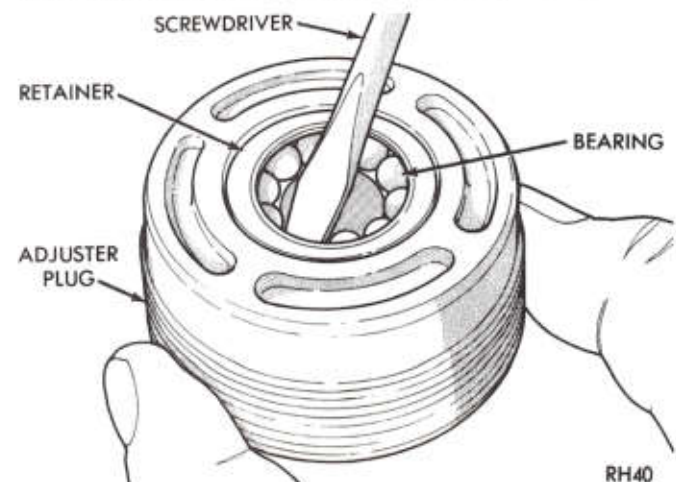


Fig. 6—Remove Lower Bearing Retainer

place while installing the guide assembly (Fig. 8).

(7) Push the guide assembly into the guide holes of the nut. If a slight bind is encountered, tap lightly into place with a screwdriver handle. After the guide assembly is in position, one ball circuit is completed.

(8) Use the same procedure to assemble the second ball circuit. Install the ball guide clamp and tighten the screws as specified. Rotate the nut on the worm to check for binding and free movement.

CAUTION: Do not rotate the nut to the end of the worm threads as damage will result to the ball guides.

Top Loading Style Ball Guide (Fig. 9)

(1) Slip the ball nut over the wormshaft with the ball guide holes up, and the shallow end of the ball nut teeth to the left as viewed from the steering wheel position. Align the grooves in the worm and nut by sighting through the ball guide holes.

(2) Place two ball guide halves together and insert them into the upper circuit in the ball nut. Place the remaining two guides together and insert them in the lower circuit.

(3) Count 25 balls into a suitable container. This is the correct number of balls for one circuit.

(4) Load the balls into one of the guide holes while turning the wormshaft gradually away from that hole. When all 25 of the balls have been installed, the circuit is complete.

(5) Fill the remaining ball circuit in the same manner as described for the first circuit.

REASSEMBLY AND INSTALLATION

Reassembly (Fig. 10)

Upon completion of a major overhaul, coat the threads of the wormshaft adjuster, side cover bolts,

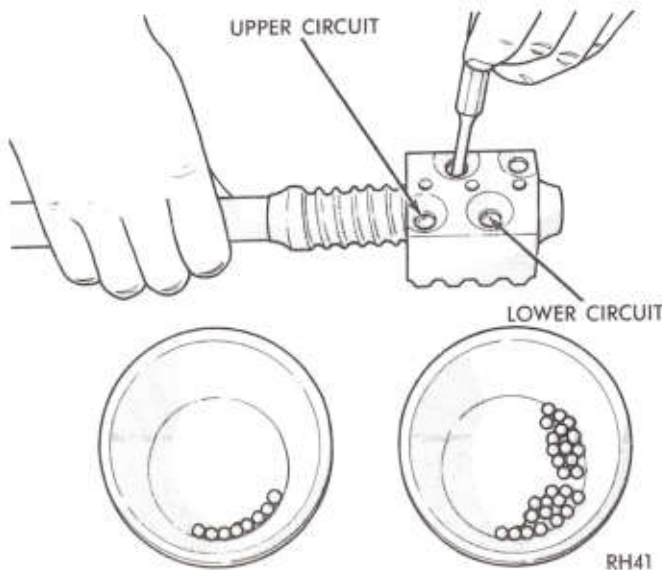


Fig. 7—Filling Ball Circuit (Closed Type)

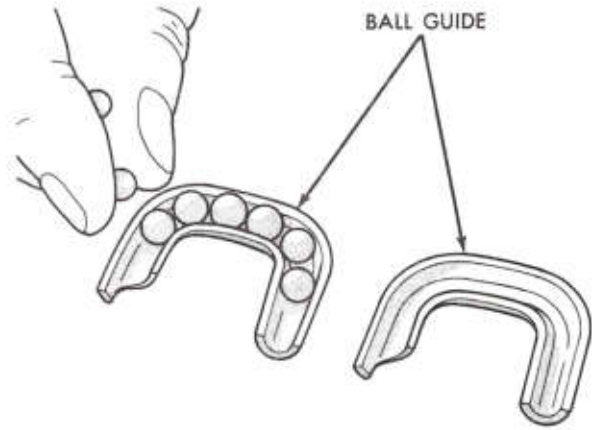


Fig. 8—Filling Ball Guides

and the sector shaft lash adjuster bolt sparingly with a nonhardening oil resistant sealing compound. This practice will aid in the prevention of lubricant leaking from the steering gear assembly.

After installing new sector shaft and wormshaft seals, and noting that the sector shaft bushings and wormshaft bearing races in the gear housing are satisfactory, continue with assembly procedures.

(1) Attach the steering gear to holding fixture Tool C-3323. Place the holding fixture in a vise, having the wormshaft bore in a horizontal position, with the side cover opening up. If fixture is not available, hold the gear housing in vise by clamping mounting lug in vise.

(2) With the upper ball bearing on the wormshaft, install the wormshaft and nut assembly into the housing, positioning the wormshaft through the upper ball bearing race and seal.

(3) Assemble the ball bearing and seal into the wormshaft adjuster plug. Press retainer into position.

(4) Place the adjuster and locknut into position guiding the wormshaft into the bearing. Tighten adjuster until very little wormshaft end play remains.

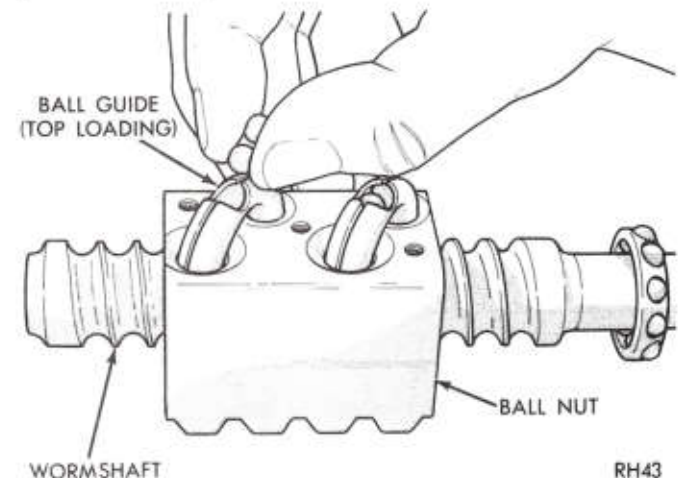
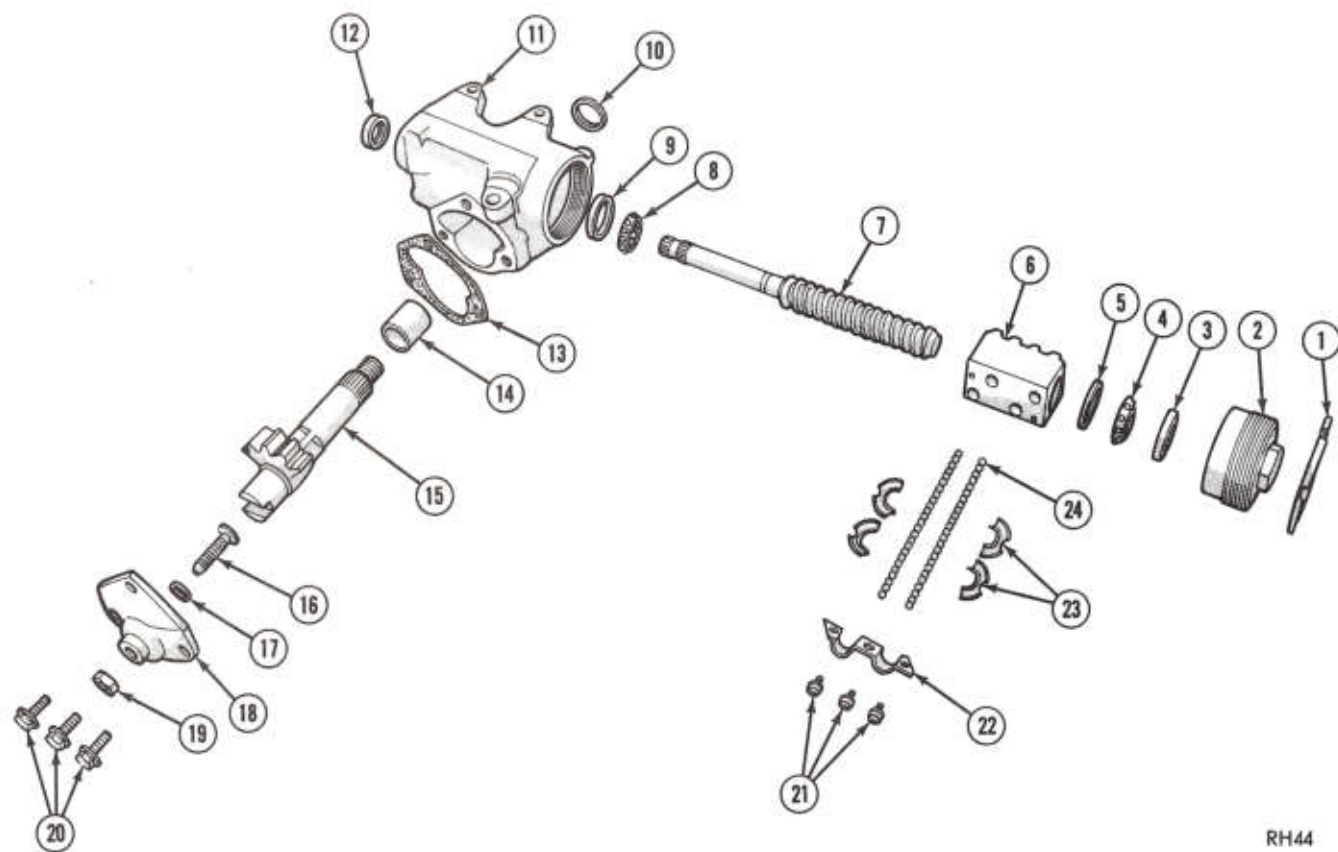


Fig. 9—Filling Ball Guide and Circuit (Top Loading Type)



RH44

Fig. 10—Manual Steering Gear**LEGEND FIG. 10**

- | | | | |
|---------------------------------|--------------------------|--|----------------------------|
| 1—Worm Bearing Adjuster Locknut | 7—Wormshaft | 13—Side Cover Gasket | 19—Lash Adjuster Locknut |
| 2—Worm Bearing Adjuster | 8—Upper Ball Bearing | 14—Sector Shaft Bushing | 20—Side Cover Bolts |
| 3—Lower Worm Bearing Cup | 9—Upper Worm Bearing Cup | 15—Sector Shaft | 21—Ball Guide Clamp Screws |
| 4—Lower Ball Bearing | 10—Sector Shaft Seal | 16—Lash Adjuster | 22—Ball Guide Clamp |
| 5—Lower Bearing Retainer | 11—Housing | 17—Lash Adjuster Shim | 23—Ball Guides |
| 6—Ball Nut | 12—Wormshaft Seal | 18—Housing Side Cover and Bushing Assembly | 24—Recirculating Balls |

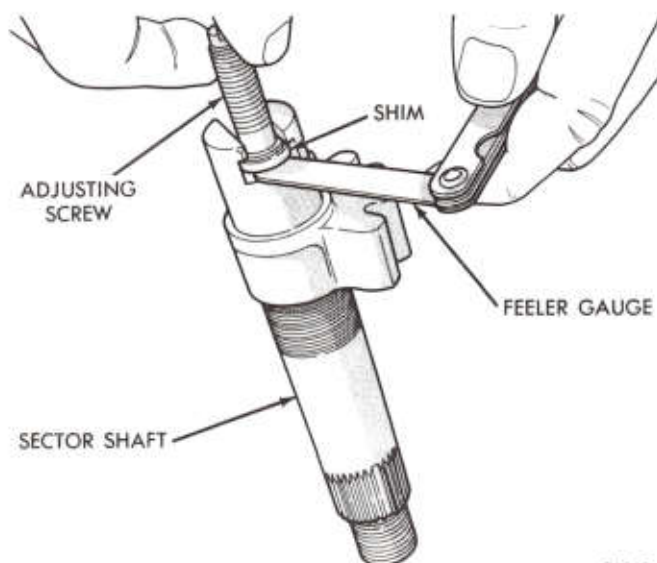
(5) Place the sector shaft lash adjuster screw, with shim, in the slotted end of the sector shaft. With adjuster screw positioned in the slot at the end of the sector shaft, check the end clearance of the screw (Fig. 11). Hold clearance to .002 inch or less. A selection of four shims having thicknesses of .063, .065, .067, and .069 inch is available.

(6) Lubricate the steering gear with steering gear grease. If steering gear grease is not available, use NLGI Grade 2 E.P. or equivalent.

Turn wormshaft until the ball nut is at the end of its travel. Pack as much lubricant into the housing as possible, without losing it out of the sector shaft opening. Turn the wormshaft until the ball nut is at its other extreme. Pack as much lubricant into the housing as possible.

(7) Rotate the wormshaft to bring ball nut to the center of its travel.

(8) Install the sector shaft assembly, including the adjuster screw and shim, into the housing. Engage the center tooth of the sector with the tooth space in the



RH45

Fig. 11—Checking Lash Adjuster End Clearance

center of the ball nut.

(9) Pack more lubricant into the housing and make sure that the side cover bushing bore is lubricated.

(10) Position side cover gasket.

(11) Install side cover; reach thorough side cover adjusting screw hole with a screwdriver and turn lash adjuster screw counterclockwise until screw bottoms, then turn opposite direction one-half turn. Start locknut and tighten finger tight.

(12) Install side cover bolts and tighten as specified.

(13) Adjust steering gear as specified.

(14) Tighten wormshaft adjuster locknut and sector shaft adjuster locknut as specified.

Installation

(1) Position steering gear to frame and install mounting bolts.

(2) Install steering arm, and place wheels in straight ahead position.

(3) Place steering wheel in straight ahead position.

(4) Install wormshaft to column coupling bolts.

(5) Tighten all bolts as specified.

POWER STEERING GEAR

INDEX

	Page		Page
Adjuster Plug	13	Rack Piston	
Disassembly	13	Disassembly	15
Reassembly	13	Inspection	15
Adjustments	7	Reassembly	15
Initial Check	7	Sector Shaft Needle Bearings and Seals	
Sector Shaft Overcenter Adjustment	11	Reassembly	16
Worm Thrust Bearing Adjustment	10	Removal	16
Gear Reassembly and Installation		Sector Shaft and Side Cover	
Installation	18	Cleaning and Inspection	15
Reassembly	17	Disassembly	15
Gear Removal and Disassembly		Reassembly	15
Disassembly	12	Valve and Stub Shaft	
Removal	11	Cleaning and Inspection	14
General Information	7	Disassembly	13
Hose Connector and Poppet Check Valve	16	Reassembly	14

GENERAL INFORMATION

Safety goggles should be worn at all times when working on any steering gear.

This power steering gear (Fig. 1) is the "variable ratio" type. This steering gear incorporates the recirculating ball system. Steel balls riding in helical grooves act as a rolling thread between the steering gear wormshaft and the rack piston. Teeth on the side of the rack piston mesh with the sector shaft. The control valve is housed inside the steering gear housing itself, making the need for an externally mounted valve assembly unnecessary.

If the hydraulic pressure in the steering system should fail, the driver, by using more effort on the steering wheel, can control the vehicle manually.

To use Steering Service Diagnosis chart, look for the squares with heavy lines which describe the condition requiring correction, then follow connecting lines into squares indicating possible causes. In most cases corrective procedures are self-evident. However, a single asterisk (*) indicates a procedure described in appropriate section of this manual. Two asterisks (**) refer to "Power Steering System Test Procedure" outlined in Power Steering Pump section.

SERVICE PROCEDURES

ADJUSTMENTS

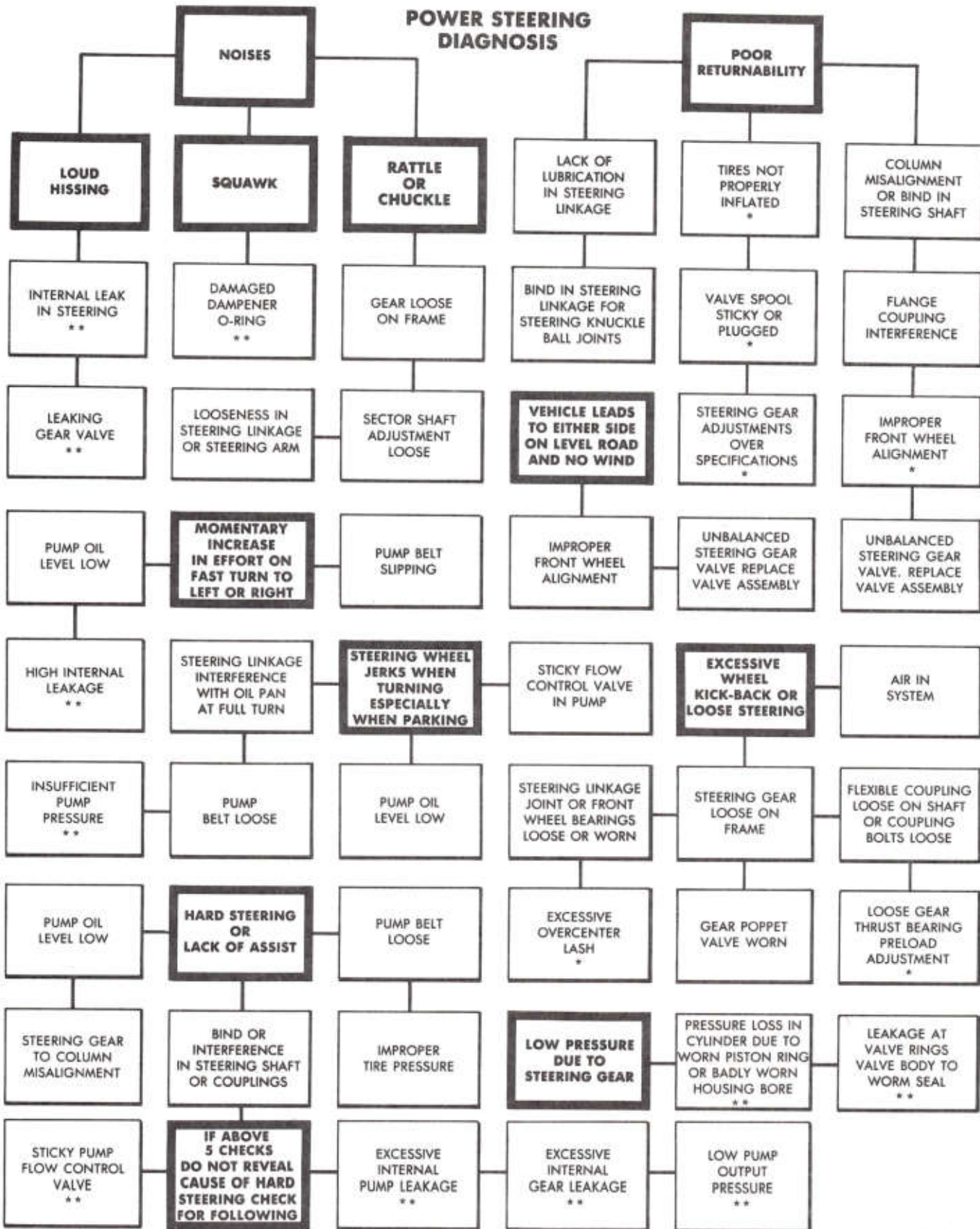
Adjusting the steering gear with the gear in the vehicle is not recommended. Having hydraulic fluid in the gear presents a variable which may cause the adjustment to be inaccurate. To prevent inaccuracy, remove the steering gear from the vehicle, mount it in a vise and make the necessary adjustments on a workbench.

(1) Initial Check

After the steering gear is removed from the vehicle drain the hydraulic fluid by rotating the gear several times through its travel.

With the steering gear removed from the vehicle, check gear adjustment torque as follows:

(a) Using a 3/4 inch twelve-point socket on the stub shaft and a torque wrench graduated in inch-pounds, check the torque 1/2 turn off the right stop, then 1/2 turn off the left stop.



*PROCEDURE DESCRIBED IN APPROPRIATE SECTION OF THIS MANUAL.

** REFER TO "POWER STEERING SYSTEM PROCEDURE" OUTLINED IN POWER STEERING PUMP SECTION.

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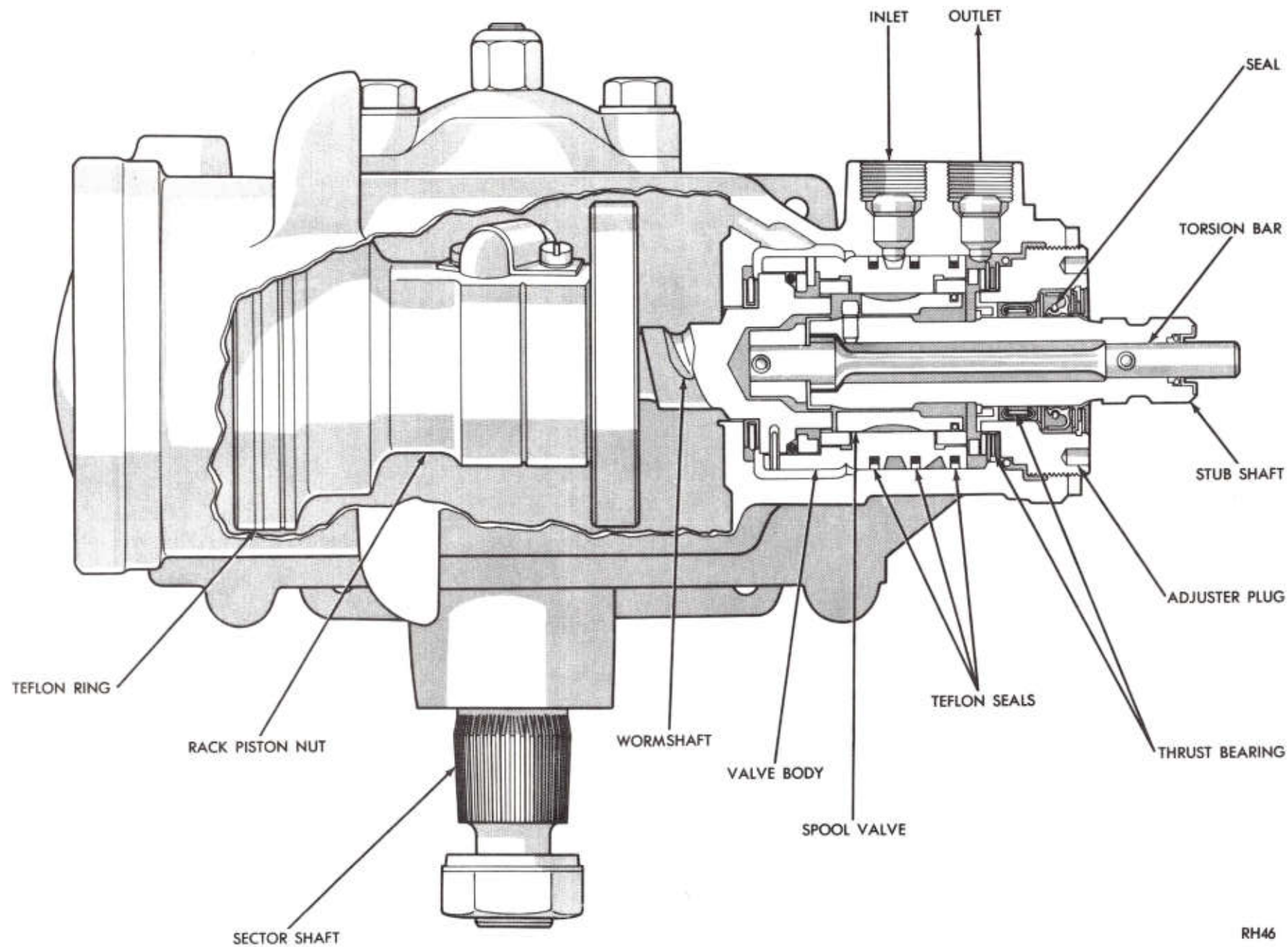


Fig. 1—Power Steering Gear

RH46

(b) Check the torque 1/2 turn off center—right and left.

(c) Check torque over center, rotating through a 180 degree arc starting from the right then starting from the left.

(2) Worm thrust bearing adjustment (Fig. 2)

(1) Loosen and remove adjuster plug locknut.

(2) Turn the adjuster plug in (clockwise) until the plug and thrust bearing are firmly bottomed—approximately 20 ft. lbs. (27 N·m).

(3) Mark the housing even with one of the holes in the adjuster plug.

(4) Measure back (counterclockwise direction) 3/16 to 1/4 inch and mark housing.

(5) Rotate adjuster (counterclockwise) until hole in adjuster is in line with second mark.

(6) Tighten locknut securely. Hold (or have held) adjuster plug to maintain alignment of hole with mark.

(7) Using an inch-pound torque wrench, turn the stub shaft to the right stop and then back 1/4 turn. Measure the torque. Reading should be taken with beam of torque wrench near vertical while turning counterclockwise at an even rate. If reading is less than 4, or more than 10 in. lbs., use alternate procedures as follows:

(1) Loosen sector shaft preload adjuster screw locknut and turn the preload adjuster screw 1 1/2 turns counterclockwise. Retighten the locknut. (If, when turning the preload screw counterclockwise, it bottoms, turn back clockwise 1/2 turn).

(2) Loosen (but, do not remove) the adjuster plug locknut.

(3) Loosen the adjuster plug 1 turn counterclockwise.

(4) Turn the stub shaft to the right stop and then

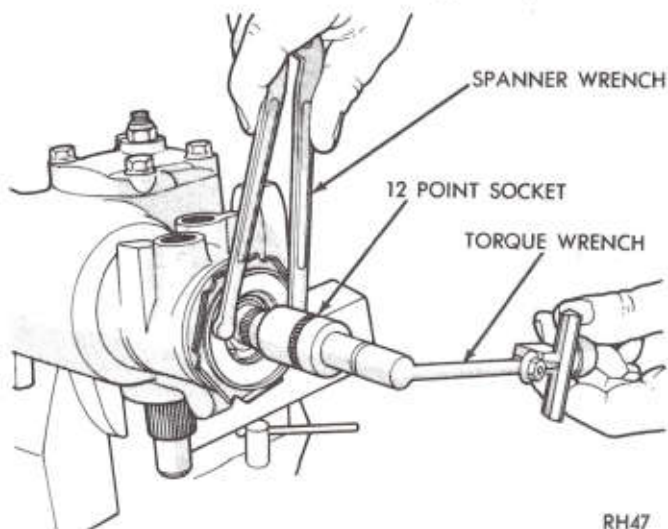


Fig. 2—Adjusting Thrust Bearing Preload

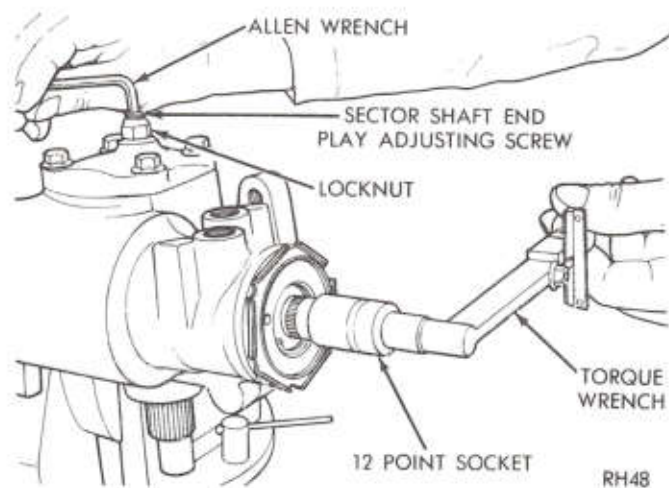


Fig. 3—Sector Shaft Overcenter Adjustment

back 1/4 turn. Measure the drag torque, using an inch-pound torque wrench. Bottom the adjuster plug firmly (approximately 20 ft. lbs.) (27 N·m) by turning it clockwise. Then back it off until the total torque reading is 3 to 4 in. lbs. in excess of the drag torque. (Example: drag torque reading—3 in. lbs. Total torque reading with adjuster plug tightened—6 to 7 in. lbs.)

(5) Tighten the adjuster plug locknut securely.

Preload torque tends to drop off when the locknut is tightened. Therefore, the torque reading must be rechecked with the locknut tight, and the torque must still be 3 to 4 in. lbs. in excess of the seal drag.

It is not possible to properly adjust the thrust bearing preload unless the adjuster plug is firmly bottomed out and the torque set while the adjuster plug is being loosened. Never attempt to adjust the

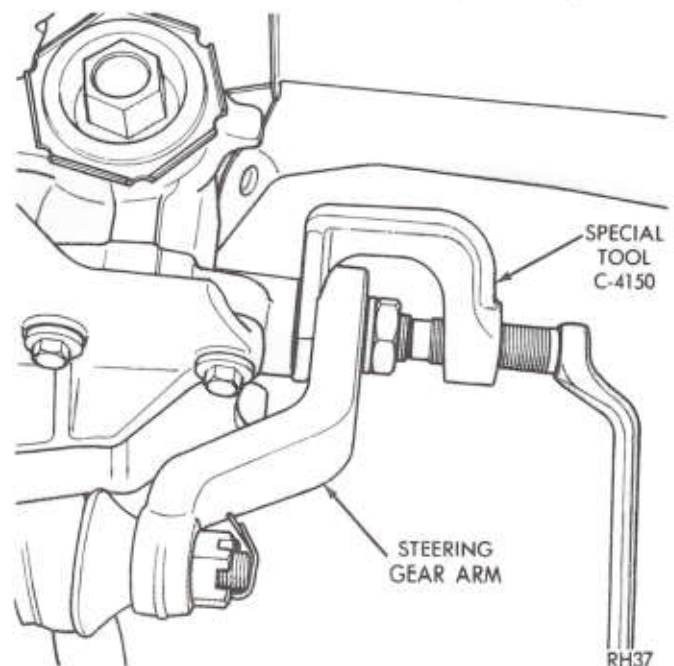


Fig. 4—Remove Steering Gear Arm

thrust preload while tightening or advancing the adjuster plug into the gear assembly.

(3) Sector shaft overcenter adjustment

(a) With gear on center, loosen locknut and tighten sector shaft lash adjuster screw. Retighten locknut and measure gear overcenter torque, rotating torque wrench in a 90 degree arc on each side of center. Note the highest reading (Fig. 3).

(b) Continue adjusting and checking until overcenter reading is within specified limits. Locknut must be tight when this reading is taken. The overcenter torque of a **new gear** should show an increase

of 4 to 8 in. lbs. over thrust bearing adjustment, but the total must not exceed 18 in. lbs.

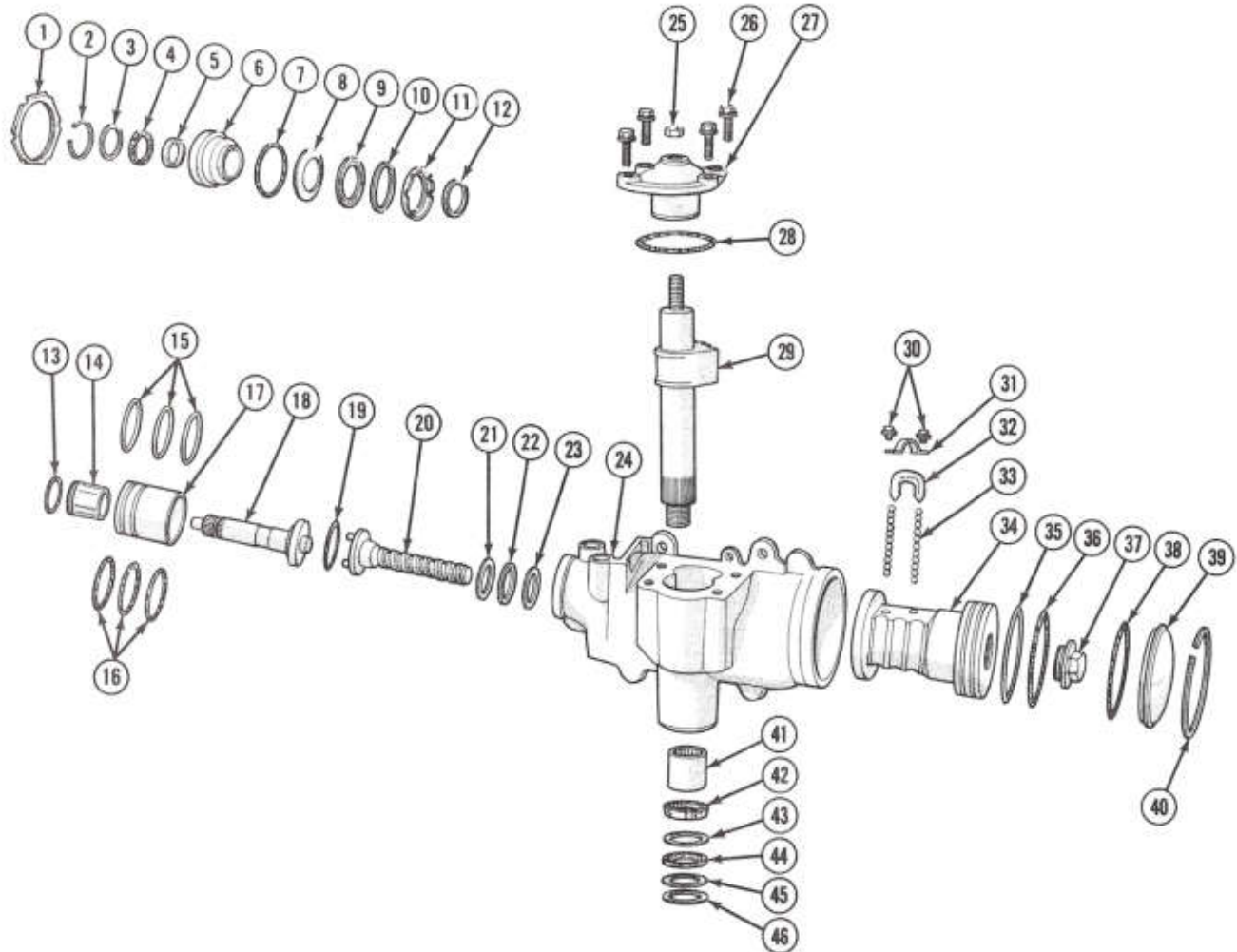
Overcenter torque of a **used gear**, having 400 miles, should be 4 to 5 in. lbs. increase, but not exceed 14 in. lbs. total.

Total overcenter torque includes the thrust bearing, overcenter and internal friction, or drag torque.

REMOVAL AND DISASSEMBLY

Removal

- (1) Center steering gear.
- (2) Remove steering gear arm using Tool C-4150 (Fig. 4).



RH50

Fig. 5—Power Steering Gear

LEGEND FIG. 5

- | | | | | |
|---------------------------|----------------------|-----------------------------|--------------------------------------|-----------------------|
| 1. Locknut | 11. Spacer | 21. Thrust Washer | 30. Retainer Screws and Lock Washers | 38. O-Ring |
| 2. Retaining Ring | 12. Retainer | 22. Thrust Bearing | 31. Guide Retainer | 39. Housing End Cover |
| 3. Dust Seal | 13. O-Ring | 23. Thrust Washer | 32. Ball Return Guide | 40. Retainer Ring |
| 4. Oil Seal | 14. Spool Valve | 24. Housing | 33. Recirculating Balls | 41. Needle Bearing |
| 5. Bearing | 15. Teflon Oil Rings | 25. Locknut | 34. Rack Piston | 42. Oil Seal |
| 6. Adjuster Plug | 16. O-Rings | 26. Cover Bolts and Washers | 35. Oil Seal | 43. Back-up Washer |
| 7. O-Ring | 17. Valve Body | 27. Side Cover | 36. O-Ring | 44. Oil Seal |
| 8. Thrust Washer (Large) | 18. Stub Shaft | 28. O-Ring | 37. Plug | 45. Back-up Washer |
| 9. Thrust Bearing | 19. O-Ring | 29. Sector Shaft | | 46. Retaining Ring |
| 10. Thrust Washer (Small) | 20. Wormshaft | | | |

- (3) Disconnect pressure and return hoses.
- (4) Disconnect steering gear to shaft coupling.
- (5) Remove steering gear to frame bolts, and remove gear from Chassis.

Disassembly (Fig. 5)

Drain gear assembly. To drain, rotate stub shaft through its range from stop to stop several times. Plug all ports immediately after disconnecting hoses and before removing gear from vehicle. Cap all hoses. Complete cleaning and drying the assembly before placing on bench. **When working with the steering gear, utmost cleanliness must be observed because of close tolerances involved.** Make sure that a clean work bench or table is used if it is necessary to disassemble any of the component parts.

All internal parts must be cleaned in clear solvent and dried with compressed air. Keep each part separate to prevent nicks and burrs. Avoid wiping valve parts with cloth, as lint may cause binding and sticking of the closely fitted parts. Never steam clean hydraulic steering assemblies. Do not force closely-fitted parts, as damage may result.

(1) Remove the cover retainer ring from the housing. Rotate the ring until one end is near the hole in the side of the housing, then pry it out (Fig. 6). Discard the oil seal.

(2) Push end cover out of housing by turning the stub shaft counterclockwise.

CAUTION: Do not turn stub shaft further than necessary to remove end plug as balls from the rack piston will fall and lay loose inside the rack piston chamber.

(3) Remove the rack piston end plug (Fig. 7). To help loosen end plug, give it a sharp rap using a hammer and brass drift.

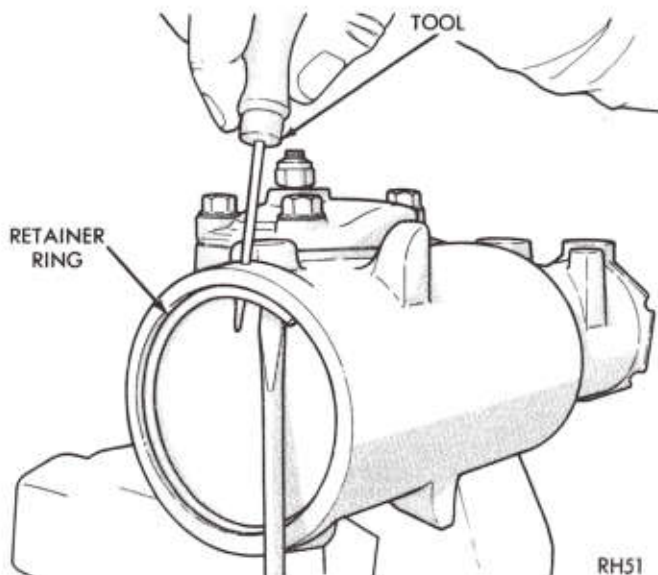


Fig. 6—Remove End Cover Retaining Ring

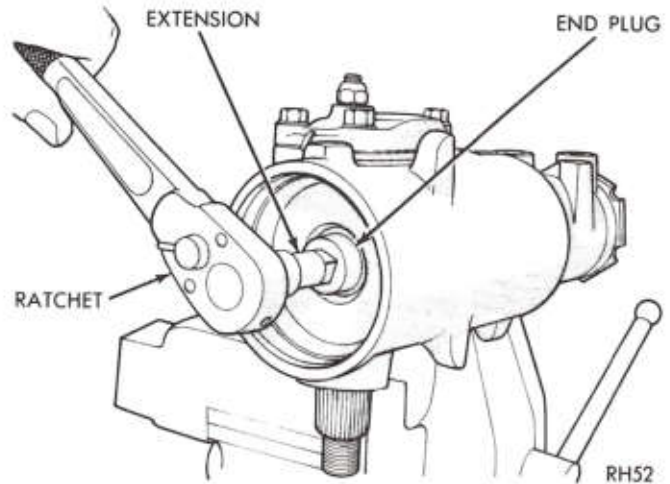


Fig. 7—Remove Rack Piston End Plug

(4) Remove sector shaft and side cover.

(a) Loosen the sector shaft adjusting screw locknut; remove the four side cover attaching bolts and lockwashers.

(b) Turn the side cover until the rack piston and sector teeth are in view, then turn the stub shaft until the sector is centered in the housing opening. Remove side cover and sector shaft from housing by tapping the end of sector shaft with a soft hammer.

(5) Remove the rack piston by the following procedure:

(a) Install ball retainer Tool C-4175 into the rack piston bore with pilot of the tool seated in the end of the worm (Fig. 8). Turn stub shaft counterclockwise while holding tool tightly against worm, forcing the rack piston onto the tool.

(b) Remove the rack piston from the housing keeping the ball retainer tool in place to hold balls in position.

(6) Remove the adjuster plug locknut; remove the

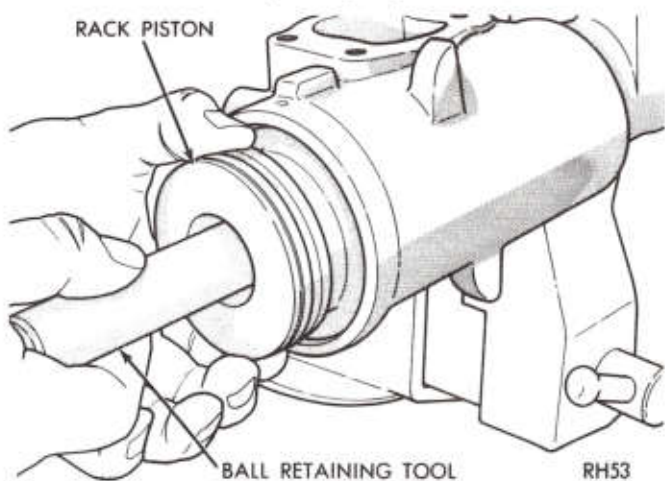


Fig. 8—Remove Rack Piston (Ball Retaining Tool in Position)

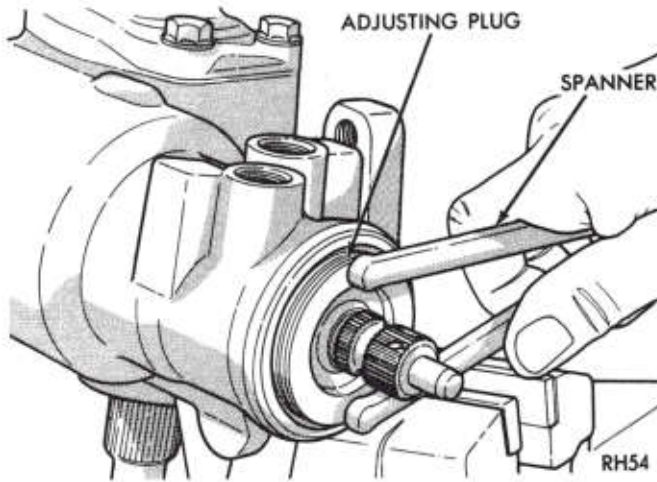


Fig. 9—Remove Adjuster Plug

adjuster plug assembly, using spanner wrench (Fig. 9). Discard O-ring.

(7) While holding the stub shaft, pull the valve assembly and stub shaft from the housing.

(8) Remove the wormshaft, lower thrust bearing and thrust washers. Discard shaft cap O-ring.

RECONDITION GEAR

ADJUSTER PLUG

Disassembly (Fig. 10)

(1) If only the oil seal is to be replaced, and not the bearing, thread the adjuster plug finger tight into housing. Using snap ring pliers C-3915, remove retainer. Pry out both dust seal and oil seal from adjuster plug bore using caution to avoid damage to the bore. Discard seals.

(2) If only the thrust bearing is to be replaced, pry out thrust bearing retainer at the two raised edges using a small screwdriver (Fig. 11). Remove spacer,

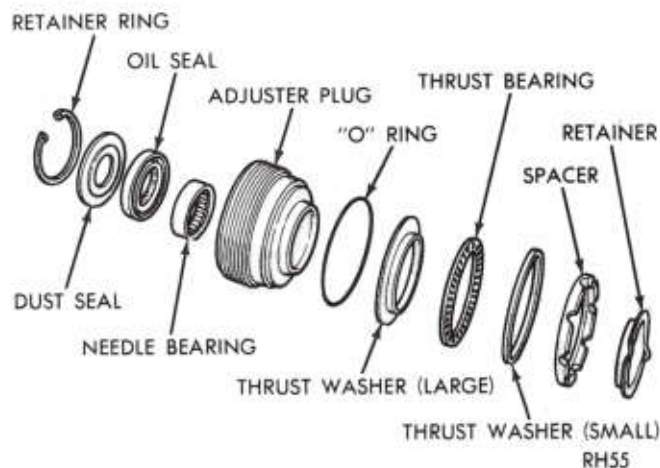


Fig. 10—Adjuster Plug

washer, thrust bearing, and washer. Discard retainer.

With thrust bearing assembly off plug, needle bearing can be removed. Using Handle C-4171 with adjuster plug bearing and seal removing Tool C-4182, drive needle bearing, dust seal, and oil seal from adjuster plug. Discard oil seal.

(3) Wash parts in clean solvent and dry with compressed air. Inspect bearing and spacer for defects. Replace if necessary.

Reassembly

(1) When replacing needle bearing, use Tool Handle C-4171 with installing Tool C-4172. Drive the bearing until tool bottoms in plug housing.

(2) Lubricate seals with power steering fluid, install the oil seal followed by the dust seal, using Handle C-4171 and installing Tool C-4172. Drive seals into adjuster plug until seated. Install retainer ring.

CAUTION: Place adjuster plug on a block of wood to protect thrust bearing surface from damage.

(3) Lubricate thrust bearing assembly with power steering fluid. Assemble thrust bearing assembly on plug inner flanged washer first, followed by thrust bearing, outer flanged washer, spacer, and retainer. (Flanges of both washers must face away from plug). Grooves on spacer should be visible when in position. Always use a new retainer. Tap new adjuster seal retainer into position using a pin punch (Fig. 12).

VALVE AND STUB SHAFT

Disassembly

(1) Remove and discard cap to wormshaft O-ring.

(2) Remove stub shaft assembly from valve body. Holding valve assembly with stub shaft down, lightly tap stub shaft against bench until cap is free from valve body by approximately 1/4 inch. (Fig. 13).

CAUTION: If the shaft assembly is pulled so the cap

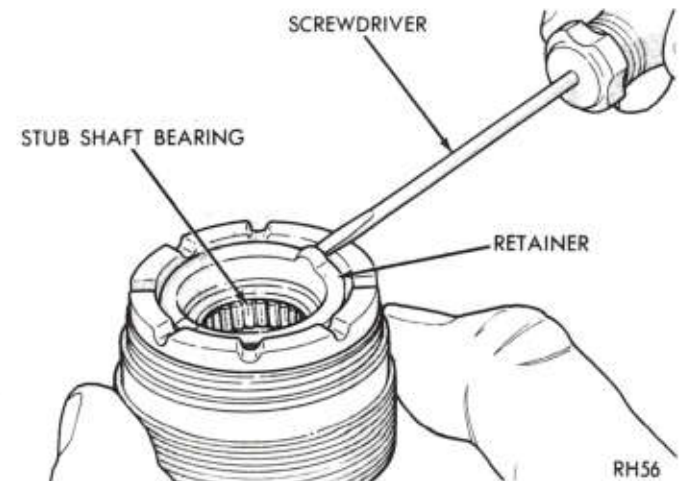


Fig. 11—Remove Thrust Bearing Retainer

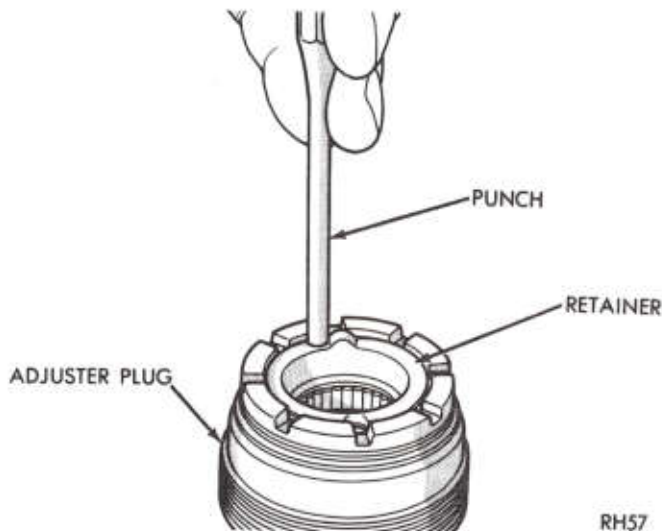


Fig. 12—Install Thrust Bearing Retainer

clears the valve body much over 1/4 inch, the spool valve may become tilted and will bind.

(3) Remove shaft assembly from spool by disengaging the shaft pin (Fig. 13). Remove spool from valve body by rotating it while removing. During removal, if binding occurs, realign the spool valve, then remove (Fig. 14). Remove and discard O-ring.

Cleaning and Inspection

(1) Wash all parts in clean solvent and dry with compressed air.

(2) Check drive pin in the stub shaft and the valve body for wear or damage. Replace the complete valve and shaft assembly if damage or wear is detected.

(3) Check for signs of leakage between the stub shaft and torsion bar. Check for nicks or scores on the stub shaft finished surfaces. If leakage is detected, the

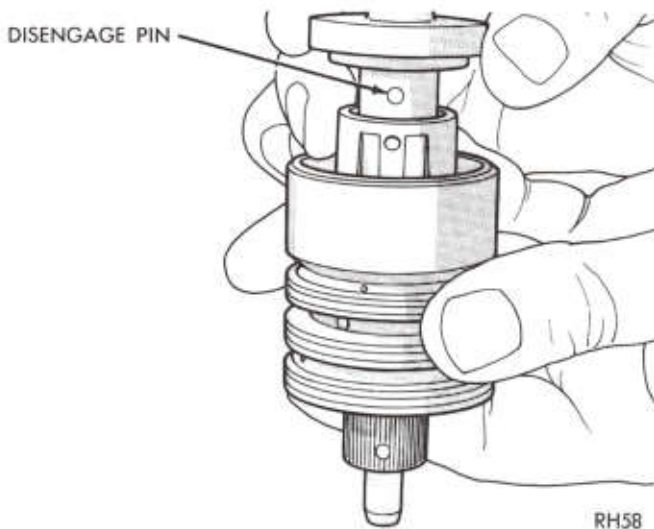


Fig. 13—Remove Stub Shaft from Spool Valve

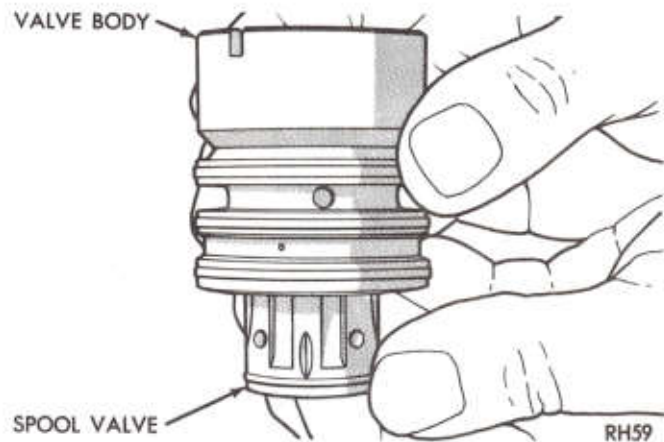


Fig. 14—Remove Spool Valve

nicks and scores cannot be corrected with crocus cloth, replace the valve and shaft assembly.

(4) Check the notch in the valve body skirt for wear. Replace the complete valve and shaft assembly if excessive wear is noted.

(5) If valve body inside diameter or spool valve outside diameter is nicked or shows excessive wear and cannot be corrected with the use of crocus cloth, replace the complete valve and shaft assembly.

(6) Check fit of the spool valve in the valve body. Lubricate the spool valve with power steering fluid and with the O-ring removed, rotate the spool valve in the valve body. If the valve does not rotate freely, replace the complete valve and shaft assembly.

Reassembly (Fig. 15)

Lubricate O-rings and parts with power steering fluid before assembling.

(1) Install new O-rings; position new teflon rings

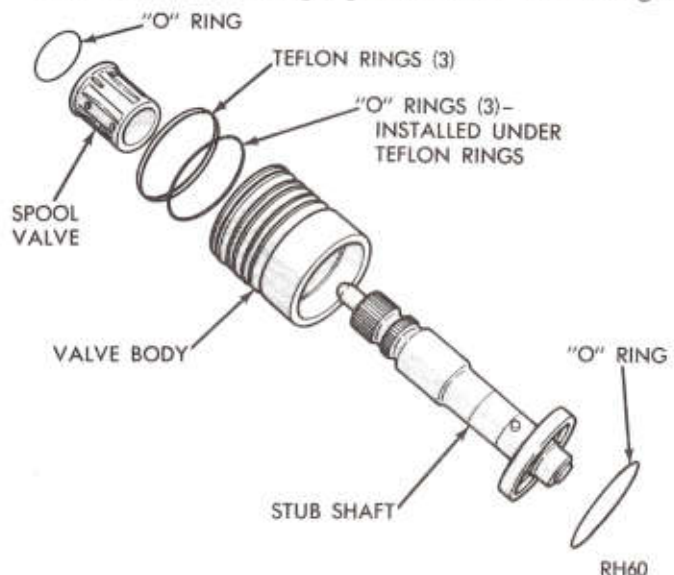


Fig. 15—Valve Body and Shaft

over the O-rings. The teflon rings may have the appearance of an improper fit, but heat generated from normal steering gear operation will cause them to seat.

(2) Install O-ring over spool valve.

(3) Enter the spool valve into the valve body. Push while rotating it slightly until the shaft pin hole is visible from the opposite end with the spool valve flush with shaft cap end of valve body.

(4) Position the stub shaft assembly into the spool valve until the shaft pin can be engaged in the hole in spool valve.

(5) Position the shaft cap so the notch aligns with the pin in the valve body; press the spool valve and shaft assembly into the valve body. The valve body pin must mate with the cap notch before the valve body is installed into the gear assembly. Install new O-ring in shaft cap end of valve body assembly (Fig. 16).

SECTOR SHAFT AND SIDE COVER

Disassembly

Remove locknut and discard. Remove side cover.

Cleaning and Inspection

(1) Wash parts in clean solvent and dry with compressed air.

(2) Check sector shaft journals and side cover bearing for nicks, excessive wear or scored surface. If irregularities or roughness in the sector shaft journal surface finish cannot be corrected with the use of crocus cloth, or the teeth are damaged, replace the shaft.

(3) If sector shaft lash adjusting screw has any perceptible end play, it must be replaced.

Reassembly

Thread the adjusting screw into the side cover until it bottoms, then back it out 1/2 turn. Install but do not tighten locknut.

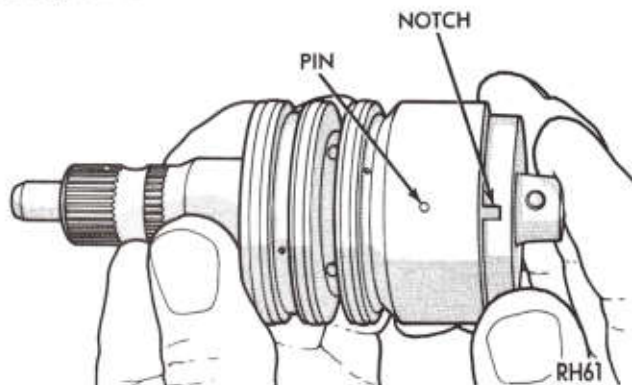


Fig. 16—Install Stub Shaft Assembly

RACK PISTON

Disassembly

Remove ball return guide clamp by removing two screws. Remove guide, arbor tool, and recirculating balls.

Inspection

(1) Inspect worm and rack piston grooves and all balls for wear or defects. If either worm or rack piston is defective, both must be replaced as a matched set.

(2) Check the ends of the ball return guide for damage. Check thrust bearings and washers for excessive wear. Check the teeth on the rack piston for scored surface or excessive wear. Inspect surface finish in critical areas for defects.

Reassembly

(1) Install new teflon seal and O-ring, if they had been removed (Fig. 17). Lubricate with power steering fluid before installation.

(2) Position the wormshaft fully into the rack piston; rotate the wormshaft to align the wormshaft groove with the ball return guide hole nearest the piston ring (Fig. 18).

(3) While slowly rotating the wormshaft counter-clockwise, feed 17 (or 19) balls into the guide hole nearest the piston ring.

CAUTION: Install the proper number of balls as described in the "Recirculating Ball Service Kit".

CAUTION: Install the black and silver balls alternately as the black balls are .0005 inch smaller than the silver balls.



Fig. 17—Install Ring on Rack Piston

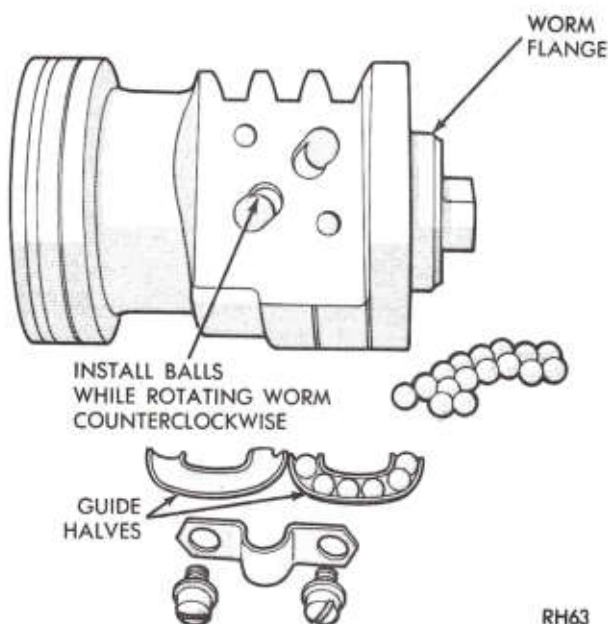


Fig. 18—Install Balls in Rack Piston Nut

(4) Place 5 balls maintaining the same alternate sequence, into the ball return guide. Apply a dab of grease at each end of the guide, replace the other half of guide and insert guide into the holes of the rack piston.

(5) Install return guide clamp, screws and lock-washers. Tighten as specified. Remove wormshaft from rack piston as Tool C-4175 is inserted in its place.

HOSE CONNECTOR AND POPPET CHECK VALVE

Removal and Installation

(1) Disconnect pressure and oil return hoses. Cut threads in connector seat using 5/16 inch x 18 tap. Cut only two or three threads to prevent damage to the check valve.

(2) Using a 5/16 inch x 18 bolt, nut and flat washer, screw the bolt into the threaded hole. Hold the bolt with a wrench while turning the nut to bear against the washer. The washer being lodged against the gear housing will cause the bolt to move out, pulling the connected seat from the housing. Discard connector seat.

(3) Clean housing making sure that no metal chips or dirt remain.

(4) Remove poppet check valve and spring from the pressure port and discard.

(5) Install new check valve spring in pressure port with large end down. Make sure spring is seated in pressure port counterbore.

(6) Place new check valve over spring with tangs pointing down. Make sure valve is centered on the small end of the spring.

(7) Using petrolatum to hold connector seat on check valve, drive the seat in place using driver. Check the valve for operation by pushing on valve using a small pin punch.

(8) Connect pressure and oil return hoses.

SECTOR SHAFT NEEDLE BEARING AND SEALS

Removal

(1) Remove the seal retaining ring using internal pliers C-3915 and remove outer steel washer. Pry out seal using screwdriver (Fig. 19). Remove inner steel washer, then pry out seal; discard seals. (Fig. 20).

CAUTION: Use care when prying out seals to avoid scoring the housing bore.

(2) To remove needle bearing use Tool C-4171 with C-4177 adapter. This bearing has a shoulder so it must be pressed from the housing by applying pressure from the side cover area of the housing.

Reassembly

(1) Using Tool C-4171 and adapter C-4178, install needle bearing on bearing installing tool with bearing face against tool. Position the bearing in the housing having identification marks away from tool then press in until the tool bottoms against the housing. When the shoulder of the tool contacts the gear housing the bearing is correctly positioned (Fig. 21).

(2) To install the sector shaft seal, place adapter C-4178 over Tool C-4171 then install the double lipped outer seal, steel inner washer and inner seal. Make sure that the lips of both seals face toward the housing bore when installing (Fig. 22).

(3) After removing the installing tool and adapter, position the steel outer washer and seal retainer. Using Tool C-4171 with adapter C-4178 drive the seals until the retaining ring seats in its groove. Remove adapter, install steel washer and snap ring.

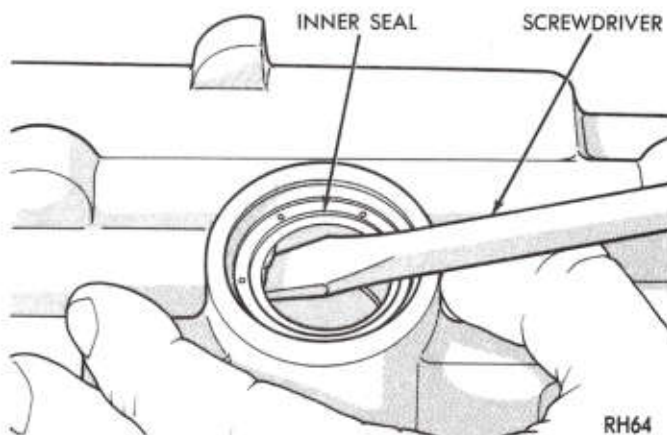


Fig. 19—Pry Out Inner Seal

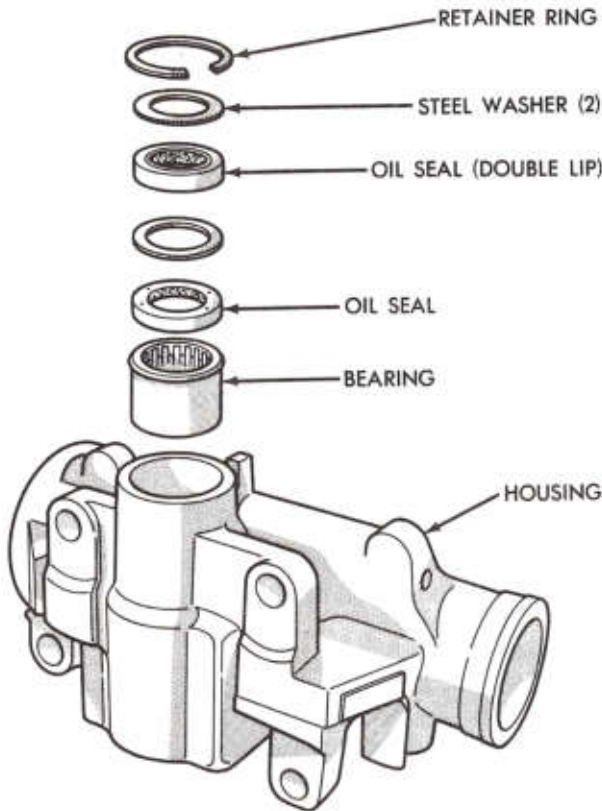


Fig. 20—Sector Shaft Bearings and Seals

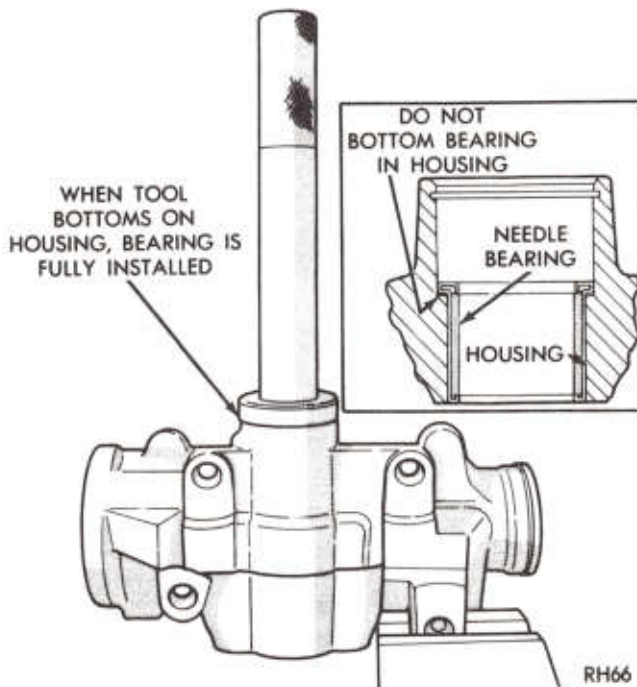


Fig. 21—Install Sector Shaft Bearing

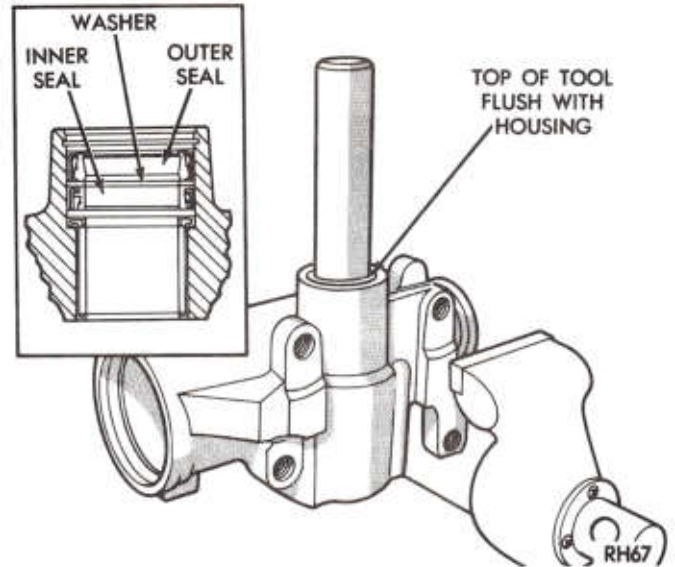


Fig. 22—Install Sector Shaft Seals
GEAR REASSEMBLY AND INSTALLATION

Reassembly

Make sure all parts are lubricated before they are assembled.

(1) Install one thrust washer, thrust bearing and finally the other thrust washer over the end of the wormshaft (Fig. 23). Position wormshaft into valve body. If thrust bearing races are tapered, install tapered surfaces parallel to each other (cupped side toward stub shaft).

(2) Install the lower cap O-ring in the valve body until it is seated against the lower shaft cap. Align the notch in the valve body with the pin in the worm;

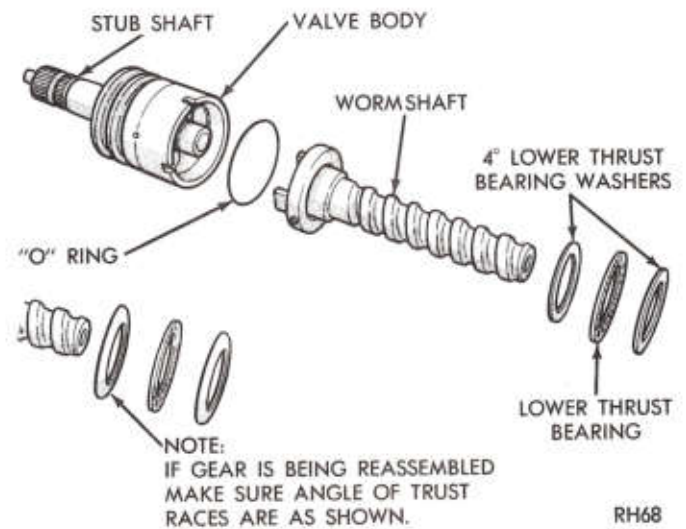


Fig. 23—Wormshaft and Valve Body

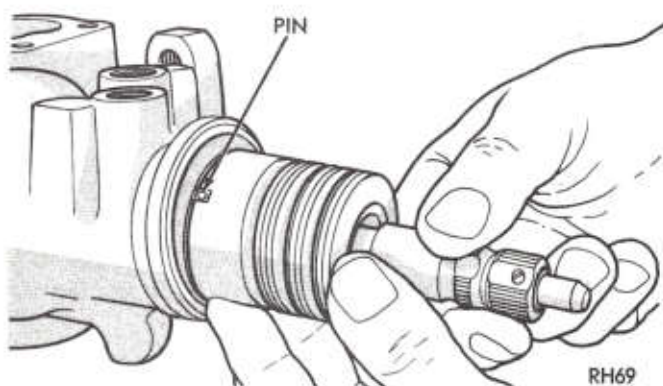


Fig. 24—Valve to Wormshaft Alignment

install the valve and shaft assembly into the gear housing (Fig. 24).

CAUTION: Apply pressure to the valve body instead of the stub shaft when installing, as pressure applied to stub shaft may force it out of the valve body (Fig. 25). The valve body is fully seated when the oil return hole in housing is uncovered (Fig. 26).

(3) Install O-ring on adjuster plug. Install adjuster plug assembly in housing until it seats against the valve body.

(4) Install rack piston.

(a) Having the ball retaining Tool C-4175 positioned in the rack piston, push the rack piston with the teeth facing the sector shaft opening until the ball retaining tool contacts the wormshaft.

(b) Holding the ball retaining tool against the end of the wormshaft, thread the rack piston onto the worm by rotating the stub shaft clockwise with a 3/4 inch socket or box end wrench. Remove the ball retaining tool when the rack piston is completely threaded on the wormshaft.

(5) Assemble on the sector shaft and side cover.

(a) Coat the new sector shaft O-ring with grease to hold it in position. Position it in the side cover. Gear may be equipped with a metal gasket having a molded rubber section.

(b) Move rack piston until teeth are centered in the sector shaft opening; install sector shaft and side cover so the sector shaft center tooth is centered with the tooth gap at the center of the rack piston.

(c) Install side cover bolts and lockwashers; tighten as specified.

(6) Install the rack piston plug; tighten as specified.

(7) Install a new housing end cover O-ring; install the end cover and retaining ring. Position gap in retaining ring approximately 1 inch from hole in housing.

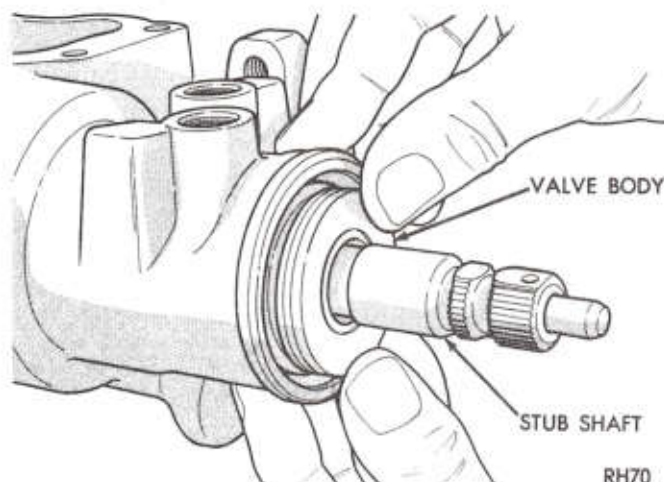


Fig. 25—Install Valve Body

- (8) Adjust the wormshaft thrust bearing preload.
- (9) Adjust the overcenter preload.

Installation

(1) Position steering gear to frame, install and tighten bolts finger tight.

(2) Install bolts in coupling and tighten as specified.

(3) Reposition gear to frame to eliminate binding; tighten bolts as specified.

(4) Connect pressure and return hoses. Tighten as specified.

(5) Center steering gear, install steering gear arm retaining nut; tighten as specified.

Replace steering arm nut and lock washer with parts having the same part numbers, or equivalent parts, if replacement becomes necessary.

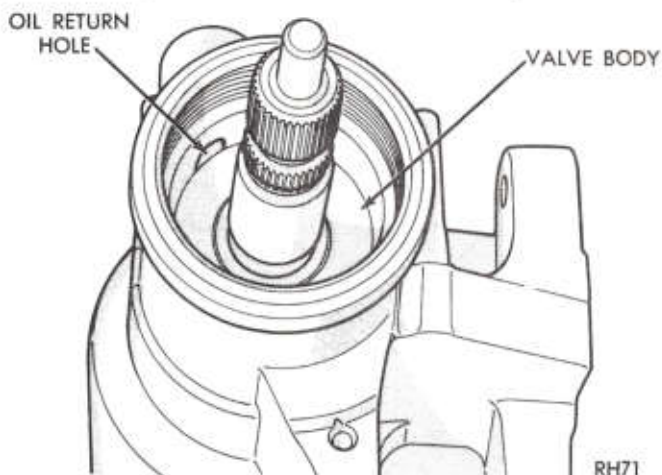


Fig. 26—Valve Body Installed in Housing

POWER STEERING PUMP

INDEX

	Page		Page
Flow Control Valve	25	Service Procedures	20
Assembly	25	Checking Fluid Level	20
Disassembly	25	Hose Installation	21
General Information	19	Oil Seal Replacement	21
Reconditioning	21	Pressure Test	20
Assembly	23	Pump Installation	21
Disassembly	21	Pump Removal	21
Inspection	22		

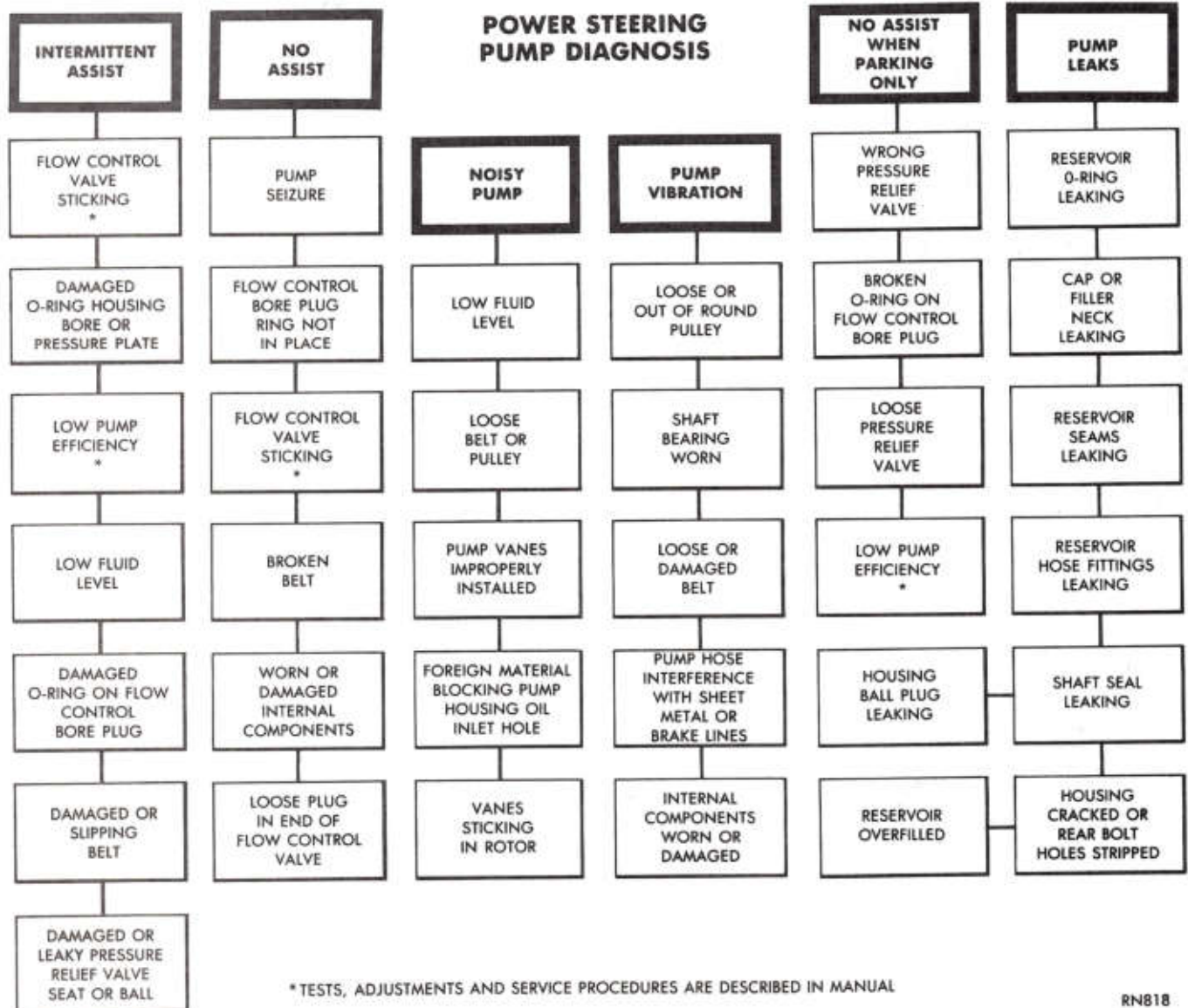
GENERAL INFORMATION

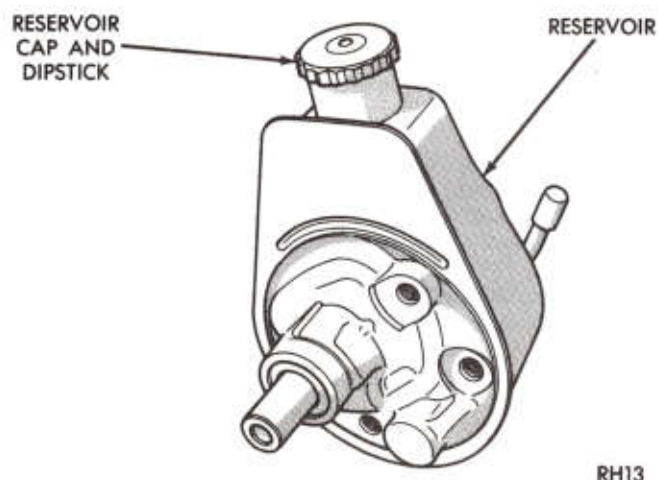
Safety goggles should be worn at all times when working on steering pumps.

The vane type power steering pump is identified by the "Ham Can" shaped reservoir and a drive pulley

secured to the driveshaft with a large nut (Fig. 1).

Rectangular pumping vanes carried by a shaft driven rotor, move the fluid from the intake to the pressure cavities of the cam ring. As the rotor begins





RH13

Fig. 1—Power Steering Pump

to rotate, centrifugal force throws the vanes against the inside surface of the cam ring to pick up residual oil which is forced into the high pressure area. As more oil is picked up by the vanes, oil is forced into

the cavities of the thrust plate, through two crossover holes in the cam ring and pressure plate which empty into the high-pressure area between the pressure plate and the housing end plate.

Filling the high-pressure area causes oil to flow under the vanes in the slots of the rotor forcing the vanes to follow the inside oval surface of the cam ring. As the vanes rotate to the small area of the cam ring, oil is forced out from between the vanes.

A flow control valve permits a regulated amount of oil to return to the intake side of the pump when excess output is generated during high-speed operation. This reduces the power requirements to drive the pump and minimize temperature build-up (Fig. 2).

To use Steering Service Diagnosis chart, look for the squares with heavy lines which describe the condition requiring correction, then follow connecting lines into squares indicating possible causes. In most cases corrective procedures are self-evident. However, an asterisk (*) indicates a procedure described in this section.

SERVICE PROCEDURES

Checking Fluid Level

The oil level in the pump should be checked **only** after pump has reached normal operating temperature. A dipstick built into the reservoir cap, indicates FULL or ADD. Fluid level should be at the FULL mark when hot.

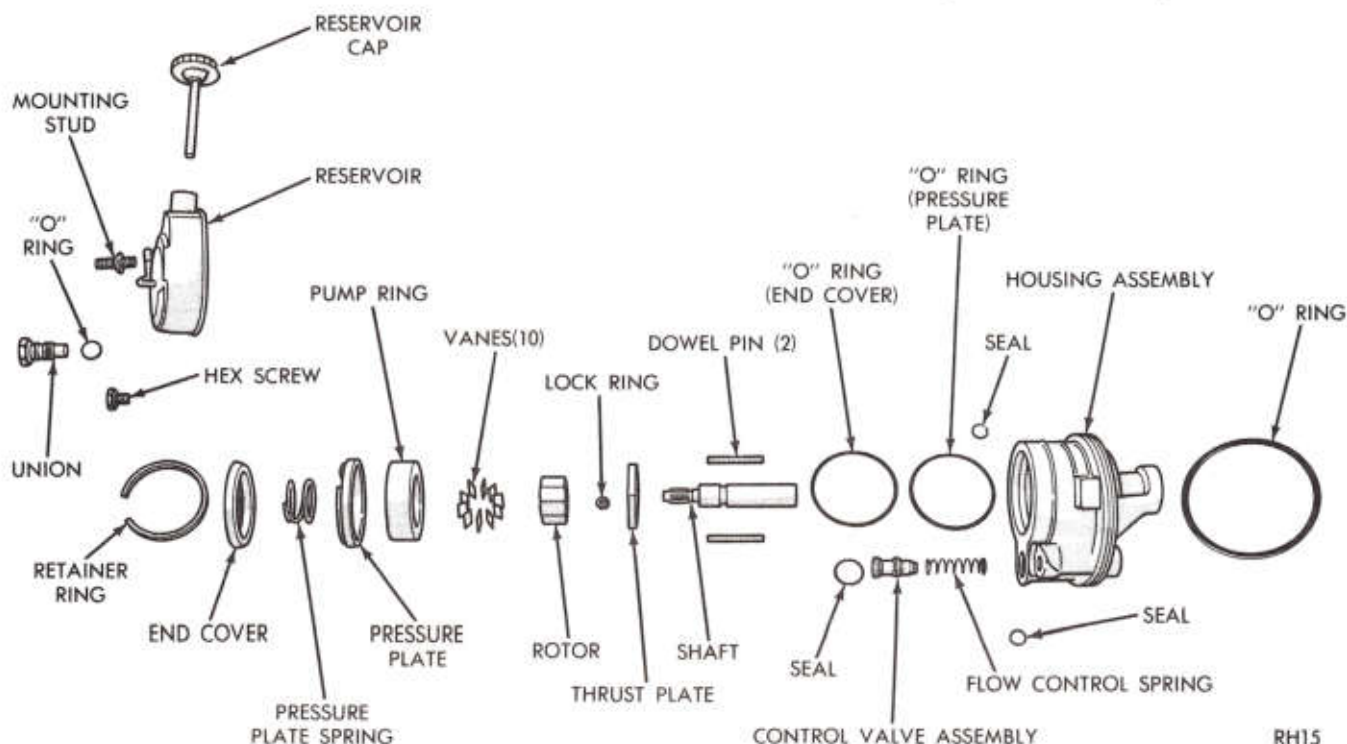
Replenish the fluid, if necessary, in all pumps with

Power Steering Fluid, Part Number 4318055, or equivalent.

CAUTION: Do NOT use automatic transmission fluid.

Pressure Test

(1) Inspect fluid level in reservoir. Fill to correct level indicated on dipstick if necessary.



RH15

Fig. 2—Power Steering Pump

(2) Measure belt tension and correct if necessary. See "Cooling System", Group 7.

(3) Disconnect the high-pressure hose at the steering gear and connect the free end of the hose to the gauge side of C-3309E. Connect a second pressure hose from the valve side of C-3309E to the steering gear. The valve must be installed on the outlet side of the gauge (Fig. 3).

(4) Insert a thermometer in fluid reservoir, start engine and warm up fluid to a temperature between 150 and 170 degrees Fahrenheit (66 and 77 degrees Celsius).

Turning the wheels from stop to stop will aid in warming the fluid. Do not hold wheels against stop for extended period as undue internal pump overheating will result.

(5) With engine idling at 600 to 800 rpm, with gauge valve open, note pressure while turning steering wheel from one extreme position to the other. Turn the wheels all the way to one or the other stop momentarily and note the maximum pressure. A pressure of at least 900 psi (6205 kPa) should be read.

(6) If pressure is under 900 psi (6205 kPa), the steering system is not functioning properly. To determine which unit is faulty, momentarily close the pressure gauge valve and note maximum pressure registered on gauge. If the pressure reads less than 900 psi (6205 kPa), the pump is faulty and should be reconditioned. Should pressure reading in step (5) read low but not in step (6), the steering gear is faulty.

When removing test equipment, be sure to reinstall hoses in original position to avoid interference with engine or sheet metal.

Pump Removal

If pump is to be disassembled, remove pulley nut before loosening belt.

(1) Loosen pump mounting and locking bolts and remove belt.

(2) Disconnect both hoses at pump.

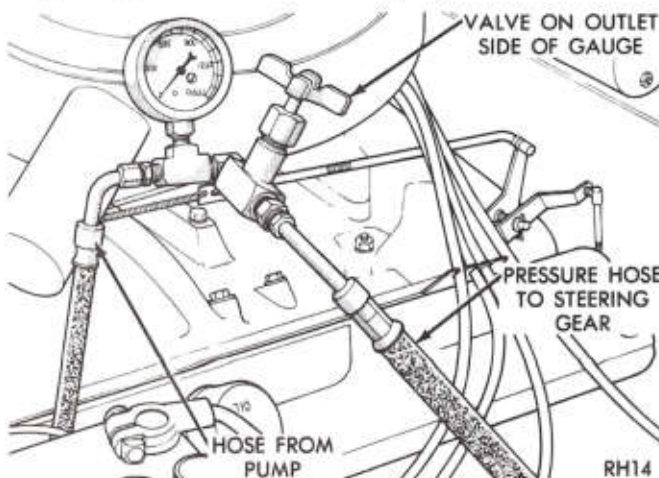


Fig. 3—Pressure Test

(3) Remove mounting and locking bolts and remove pump and bracket.

Pump Installation

(1) Position pump on engine and install mounting and locking bolts.

(2) Install drive belt and adjust. See "Cooling System—Group 7". Tighten mounting bolts to 30 ft. lbs. (41 N·m).

(3) Connect pressure and return hoses. See "Hose Installation".

(4) Fill pump reservoir to correct level with Power Steering Fluid, Part Number 4318055, or equivalent.

(5) Start engine and turn steering wheel several times from stop to stop to bleed the system. Stop engine, check oil level and correct if necessary. See "Checking Fluid Level".

Hose Installation

When either hose is reinstalled or replaced, the following points are essential:

(1) Route hoses in same position they were in before removal.

(2) Route hoses smoothly, avoiding sharp bends and kinking.

(3) Tighten pump end hose fitting to 35 ft. lbs. (47 N·m) and gear end fitting to 25 ft. lbs. (34 N·m).

Hoses must remain away from all pulleys, battery case and brake lines, and away from exhaust manifold.

(4) When used, protective sponge sleeves must be properly positioned to prevent hose contact with other components in engine compartment.

(5) After hoses are installed, check for leaks while system is being bled. See "Pump Installation".

Oil Seal Replacement

To service the driveshaft oil seal, it is necessary to remove the pump from the vehicle, disassemble and reassemble the pump as outlined in "Reconditioning".

RECONDITIONING (Fig. 2)

Disassembly

(1) Remove pump assembly from engine. Drain reservoir and reinstall filler cap to prevent contamination, then clean exterior of pump assembly before servicing.

(2) Clamp pump securely into vise at mounting bracket.

(3) Using Tool C-4068A, remove pulley. Be sure puller screw is perfectly aligned with shaft end to prevent cocking (Fig. 4).

(4) Remove brackets from pump.

(5) Using soft protective jaws, clamp pump (shaft down) in vise between square boss and shaft housing (Fig. 5).

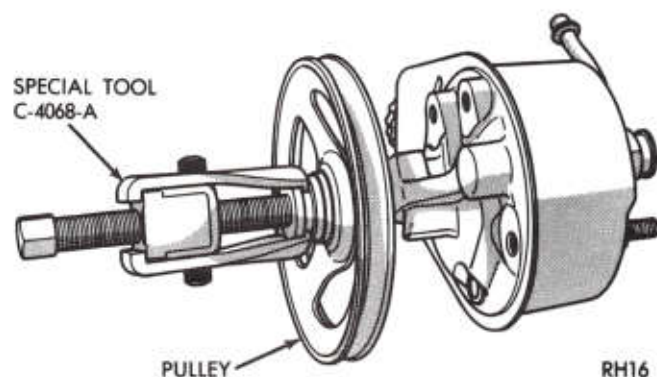


Fig. 4—Remove Pulley

(6) Remove two mounting studs and pressure hose fitting. Gently tap reservoir filler tube back and forth with plastic hammer to loosen. Work reservoir off pump body (Fig. 5). Discard O-rings from reservoir, two mounting studs and pressure fitting.

(7) Using a punch, tap end cover retainer ring around until one end of ring is near hole in pump body. Insert punch in hole far enough to disengage ring from groove in pump bore and pry ring out of pump body (Fig. 6).

(8) Tap end cover with plastic hammer to jar it loose. Spring under cover should push cover up.

(9) Remove pump body from vise, place in inverted position on flat surface and tap end of driveshaft with plastic hammer to loosen pressure plate, rotor and thrust plate assembly from body. Lift pump body off rotor assembly. Flow control valve and spring should slide out of bore also (Fig. 7).

(10) Remove and discard end cover and pressure plate O-rings.

(11) Place pump body on flat surface and pry driveshaft oil seal out with a screwdriver (Fig. 8).

(12) Inspect seal bore in housing for burrs, nicks or score marks that would allow oil to bypass outer seal surface.

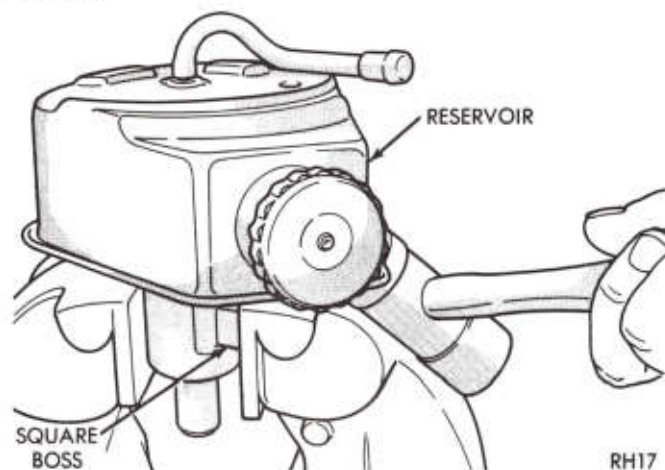


Fig. 5—Remove Reservoir

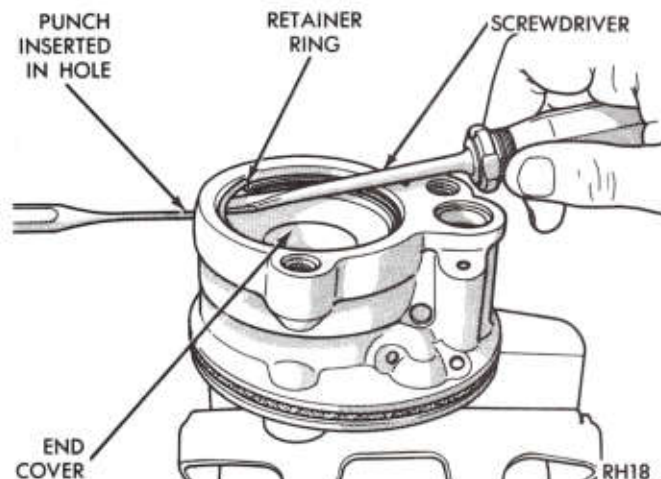


Fig. 6—Remove End Cover Retaining Ring

(13) If necessary to disassemble flow control valve for cleaning, see "Flow Control Valve Disassembly".

(14) After lifting pressure plate and cam ring from rotor, remove ten vanes from slots in rotor.

(15) Clamp driveshaft in soft-jawed vise, with rotor and thrust plate facing up.

(16) Remove rotor lock ring, pry ring off driveshaft using a screwdriver. Exercise care to avoid nicking the rotor end face. Discard ring. (Fig. 10).

(17) Slide rotor and thrust plate off shaft and remove shaft from vise.

Inspection

(1) Wash all parts in clean solvent, blow out all passages with compressed air and air dry cleaned parts.

(2) Inspect driveshaft for excessive wear and seal area for nicks or scoring. Replace if necessary.

(3) Inspect fit of vanes in rotor. Vanes must slide freely in slots of rotor without binding. Excessively loose vanes require replacement of rotor and/or vanes.

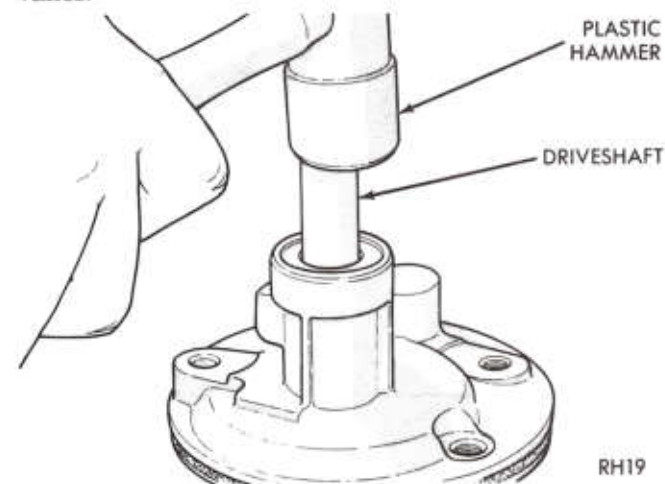


Fig. 7—Remove Driveshaft Assembly

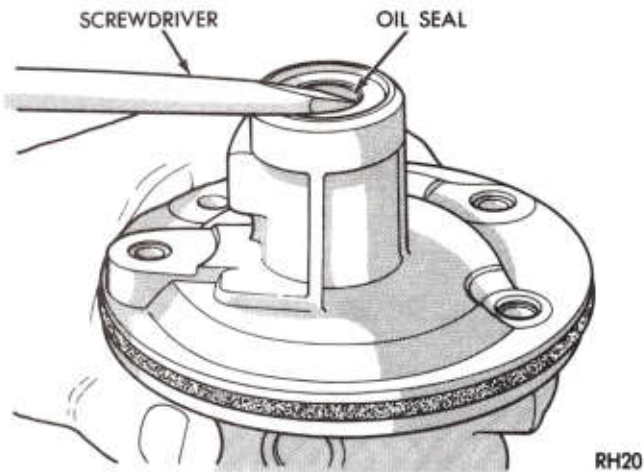


Fig. 8—Remove Seal

(4) Inspect flat surfaces of pressure and thrust plates for wear or scoring. Light scoring can be removed by lapping on a flat surface. Remove all lapping compound thoroughly before reassembly.

(5) Inspect inner surface of cam ring for heavy scuff or chatter marks. Replace if necessary.

(6) Inspect end cover for nicks or burrs on surface contacting O-ring and remove with a fine stone.

(7) Inspect pump body driveshaft bushing for excessive wear. Replace pump body and bushing as an assembly if badly worn or scored.

Assembly

(1) Place pump body on flat surface and drive new driveshaft seal into bore with a 7/8 or 15/16 inch socket until seal bottoms on shoulder (Fig. 9).

CAUTION: Excessive force will distort the seal.

(2) Lubricate seal with power steering fluid and clamp pump body in vise, (shaft end down).

(3) Install end cover and pressure plate O-rings in grooves in pump cavity. These rings are the same size. Lubricate with power steering fluid.

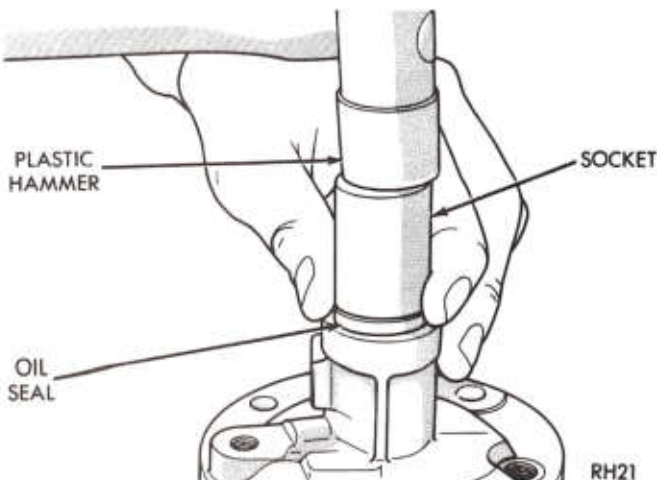


Fig. 9—Install Seal

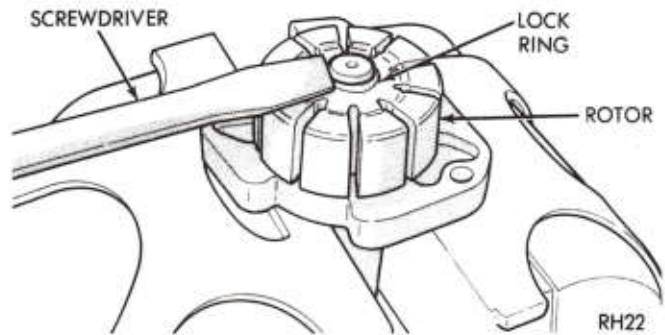


Fig. 10—Remove Full Diameter Lock Ring

(4) Lubricate large pump body to reservoir O-ring and install on pump body.

(5) With driveshaft clamped splined end up in soft-jawed vise, install thrust plate on driveshaft (ported side up) (Fig. 11).

(6) Slide rotor over splines with the counterbore of rotor facing **down**. Install rotor lock ring making sure ring is seated in groove (Fig. 12).

CAUTION: Regardless of which locking ring was originally used, always replace with a new, full diameter ring.

(7) Install two dowel pins in holes in pump cavity. Carefully insert driveshaft, rotor and thrust plate assembly in pump cavity indexing locating holes with dowel pins (Fig. 13).

(8) Slide cam ring over rotor on dowel pins with arrow on ring facing **"UP"** (Fig. 14).

(9) Install ten vanes in rotor slots (Fig. 15). Lubricate with power steering fluid.

(10) Position pressure plate on dowel pins. Place a 1 1/4 inch socket in groove of pressure plate and seat entire assembly on O-ring in pump cavity by pressing down on pressure plate with both thumbs (Fig. 16).

(11) Place spring in groove in pressure plate and position end cover lip edge up over spring.

(12) Press end cover down below retaining ring groove with vise or arbor press and install ring

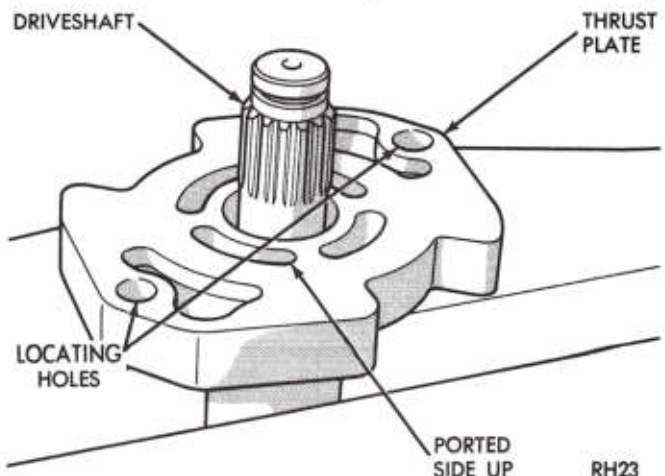


Fig. 11—Install Thrust Plate

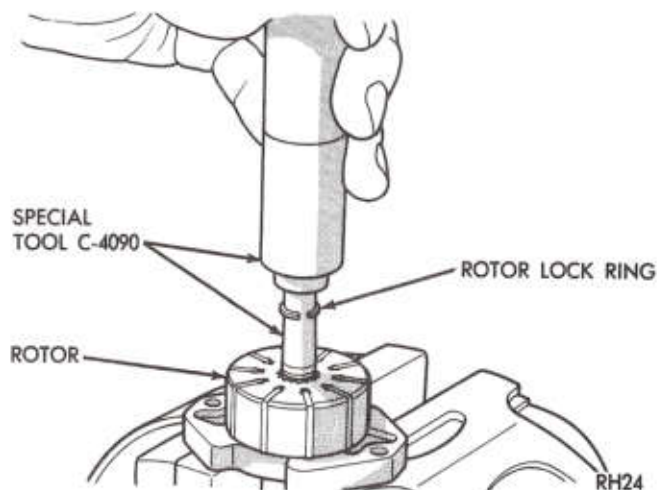


Fig. 12—Install Rotor Lock Ring

making sure it is seated in groove (Fig. 17).

This operation can be performed best in an arbor press, if available. Care should be exercised to prevent cocking the end cover in the bore or distorting the

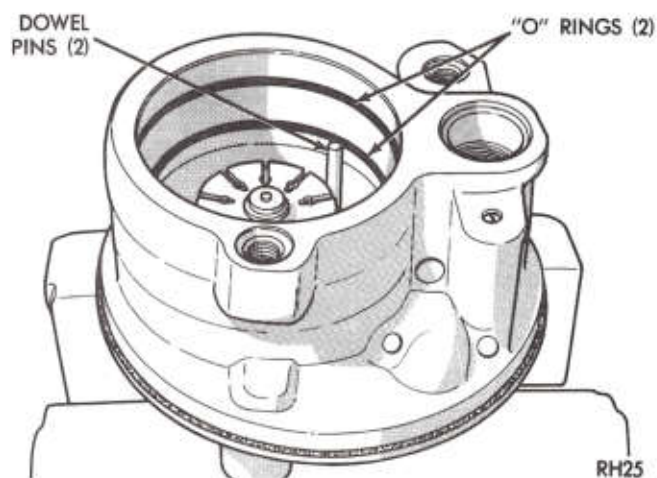


Fig. 13—Rotor and Thrust Plate Installed

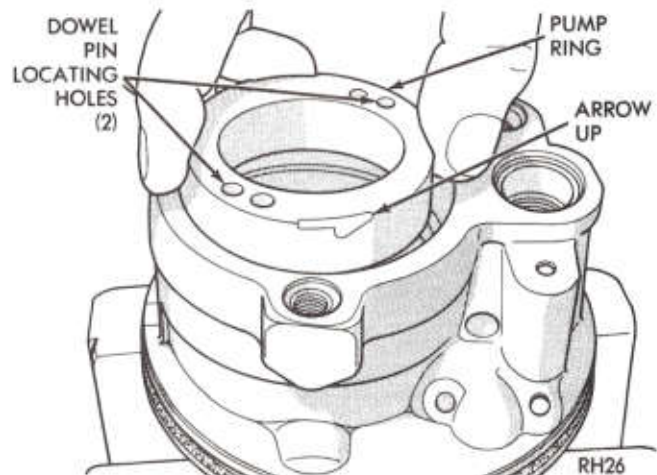


Fig. 14—Install Cam Ring



Fig. 15—Install Rotor Vanes

assembly.

(13) Using a punch, tap retainer ring ends around in the groove until gap is in line with flow control valve bore as shown.

(14) Replace reservoir O-ring, two mounting stud O-rings and flow control valve O-ring on pump body, lubricate with power steering fluid and carefully position reservoir on pump body. Visually align the mounting stud holes until studs can be started in threads.

(15) Using a plastic hammer, tap reservoir down on pump and insert flow control valve spring and valve (slotted end up).

(16) Replace O-ring on pressure hose fitting and lubricated with power steering fluid (Fig. 18).

CAUTION: Be sure O-ring is installed on upper groove. It is possible to install O-ring in lower groove. This would restrict relief outlet orifice.

(17) Install pressure hose fitting and tighten mounting studs. Tighten pressure hose fitting to 35 ft. lbs. (47 N·m) and rear mounting studs 35 ft. lbs. (47 N·m).

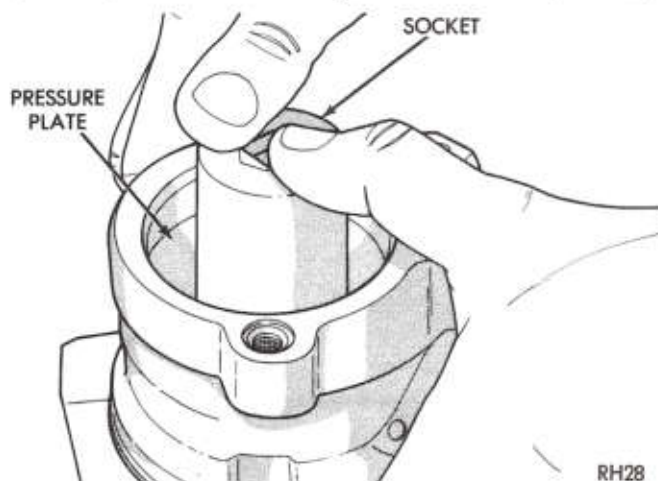


Fig. 16—Seating Pressure Plate

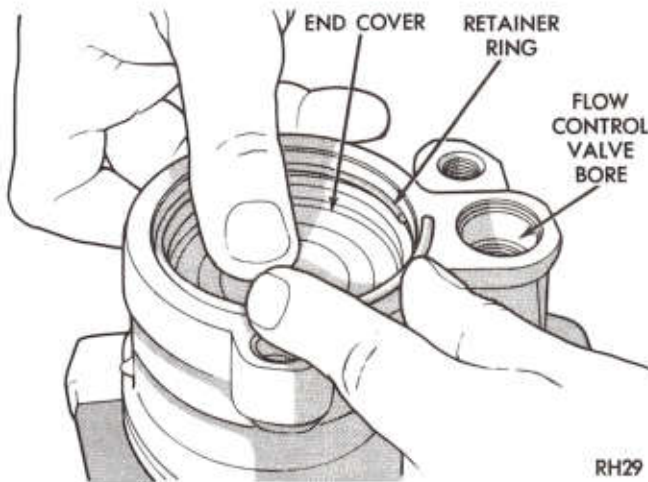


Fig. 17—Install End Cover and Retaining Ring

Installing Pulley

Using Tool C-4063 **without** adapters, install pulley on shaft. Be sure tool remains in alignment during installation. Tighten until tool bottoms on shaft (Fig. 19).

Install pump assembly on engine and refill reservoir. Start engine and inspect for leaks.

CHECKING FLUID LEVEL

Wipe reservoir filler cap free of dirt, then check fluid level. The dipstick should indicate **FULL COLD** when fluid is at normal ambient temperature (approximately 70° to 80°F) (21° to 20°C). In all pumps replenish the fluid, if necessary, with **Power Steering Fluid, Part Number 4318055 or equivalent.**

CAUTION: Do NOT use automatic transmission fluid.

FLOW CONTROL VALVE (Fig. 20)

The flow control valve is serviced as an assembly. Nicks or burrs that might cause the valve to stick in

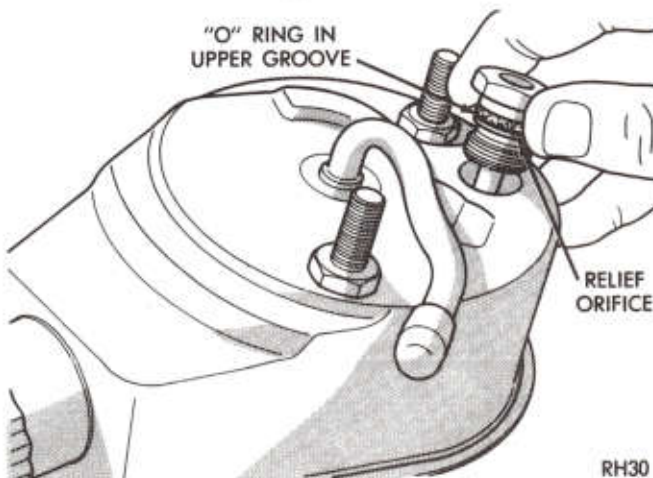


Fig. 18—Install Pressure Hose Fitting

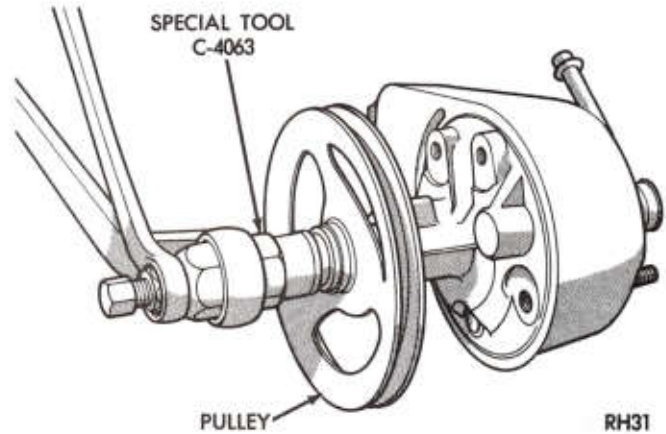


Fig. 19—Install Pulley

the bore may be removed by rubbing valve over flat surface covered by crocus cloth. Care should be taken to prevent rounding the sharp edges of the lands.

The valve may be disassembled for cleaning if dirt has caused pump failure. It is important that if the valve is disassembled for cleaning purposes, the entire pump should be disassembled and cleaned.

Disassembly

(1) Remove pressure hose fitting from pump reservoir. Discard O-ring on fitting.

(2) Withdraw valve with a magnet. If valve is stuck in bore, it may be necessary to push in on valve against spring pressure. Release pressure exerted against valve abruptly and allow valve to spring out of bore.

(3) Clamp land end of valve in a soft-jawed vise and remove hex-head plug and shim(s). Note number of shims on plug. Same number of shims should be installed on assembly of valve.

(4) Remove valve from vise and remove pressure relief ball, guide and spring.

Assembly

(1) Insert spring, guide, and pressure relief ball in end of flow control valve (Fig. 20).

(2) Install hex-head plug using the same number of shims as were removed.

(3) Install the hex-head plug and tighten to 50 in. lbs. (6 N·m).

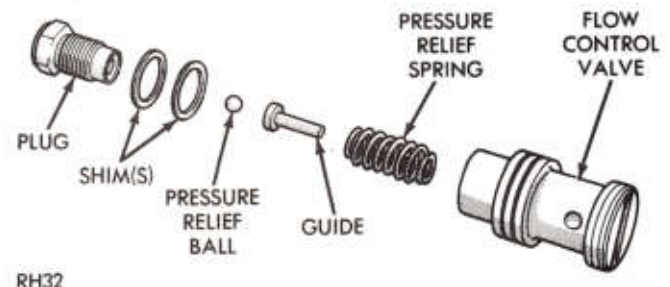


Fig. 20—Flow Control Valve

(4) Insert flow valve spring and valve in bore. Install new O-ring on the pressure hose fitting and lubricate with power steering fluid.

(5) Thread fitting into pump body and tighten to 20 ft. lbs. (27 N·m).

STANDARD STEERING COLUMN

INDEX

	Page		Page
Column Inspection	30	Reassembly	30
Disassembly	28	Removal	28
Floor Shift Column	33	Tightening Reference	40
Installation	33		

GENERAL INFORMATION

Safety goggles should be worn at all times when working on steering columns.

The steering column under head-on collision conditions is designed to telescope at a controlled rate. The telescoping action reduces the likelihood of the steering wheel being driven rearward toward the driver. If the driver is thrown forward into the wheel, the column can telescope further at the same controlled rate, thereby reducing force of the impact.

The column assembly (Figs. 1 and 2) has four principal components:

(1) A column jacket with a slotted-mesh section designed to shorten by rolling up at its lower end.

(2) A two-piece telescoping transmission gearshift tube interconnected by plastic inserts.

(3) A two-piece telescoping steering shaft of upper and lower sections connected by plastic friction collars and shear pins.

(4) A mounting bracket connecting steering column to the instrument panel, which allows the column to slide forward but blocks its rearward movement toward the driver.

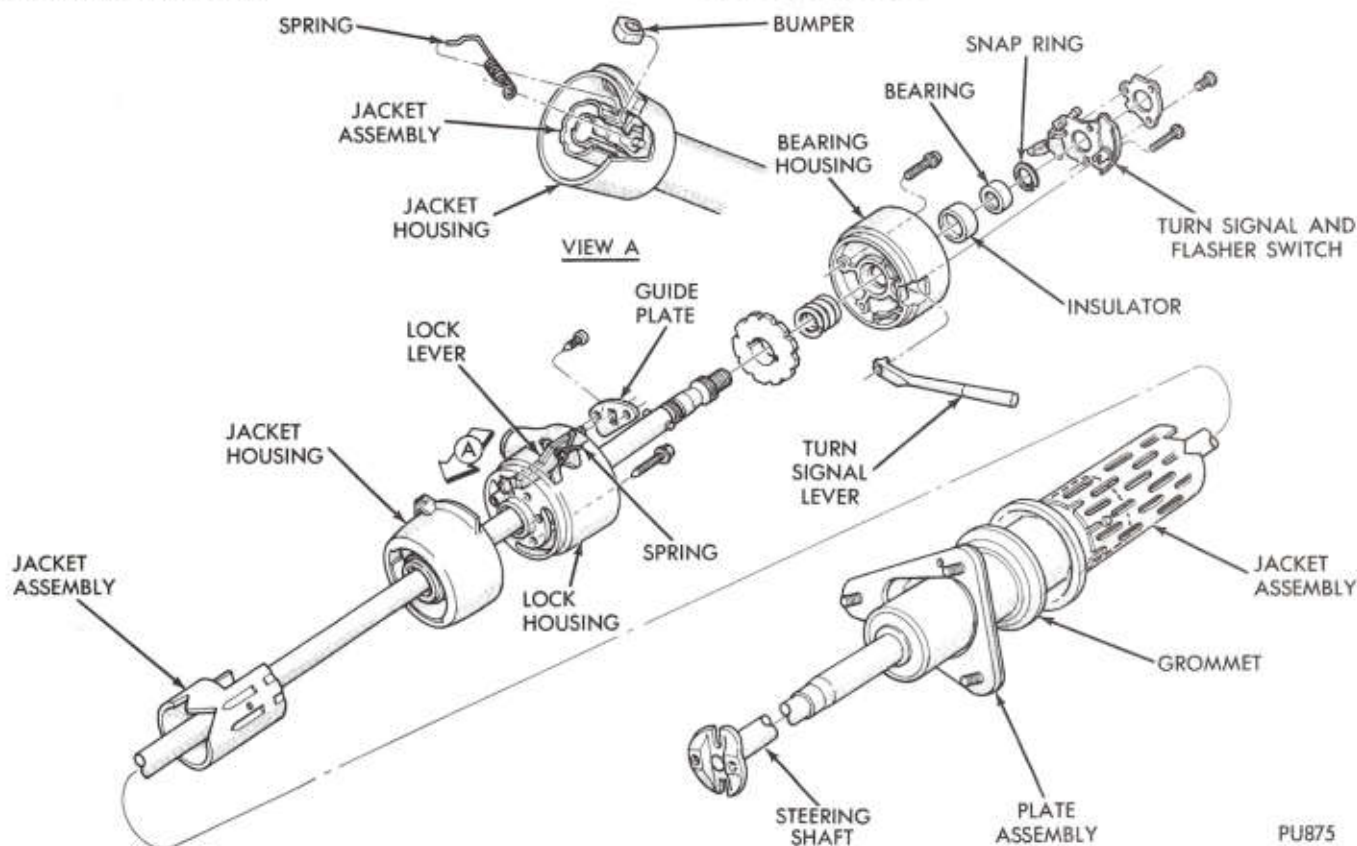


Fig. 1—Steering Column (Floor Shift)

PU875

The center section of the column jacket has side-staggered slot perforations and is riveted to an expansion mandrel. Upon application of a load, the rivets will shear and the jacket will collapse.

The gearshift tube is made up of two sections interconnected to telescope together. These sections are interconnected and held together by injections of plastic that form the interconnecting inserts and shear pins. Under impact, there is a gradual paring away of the inserts by the knife-like edge in the adjoining tube section.

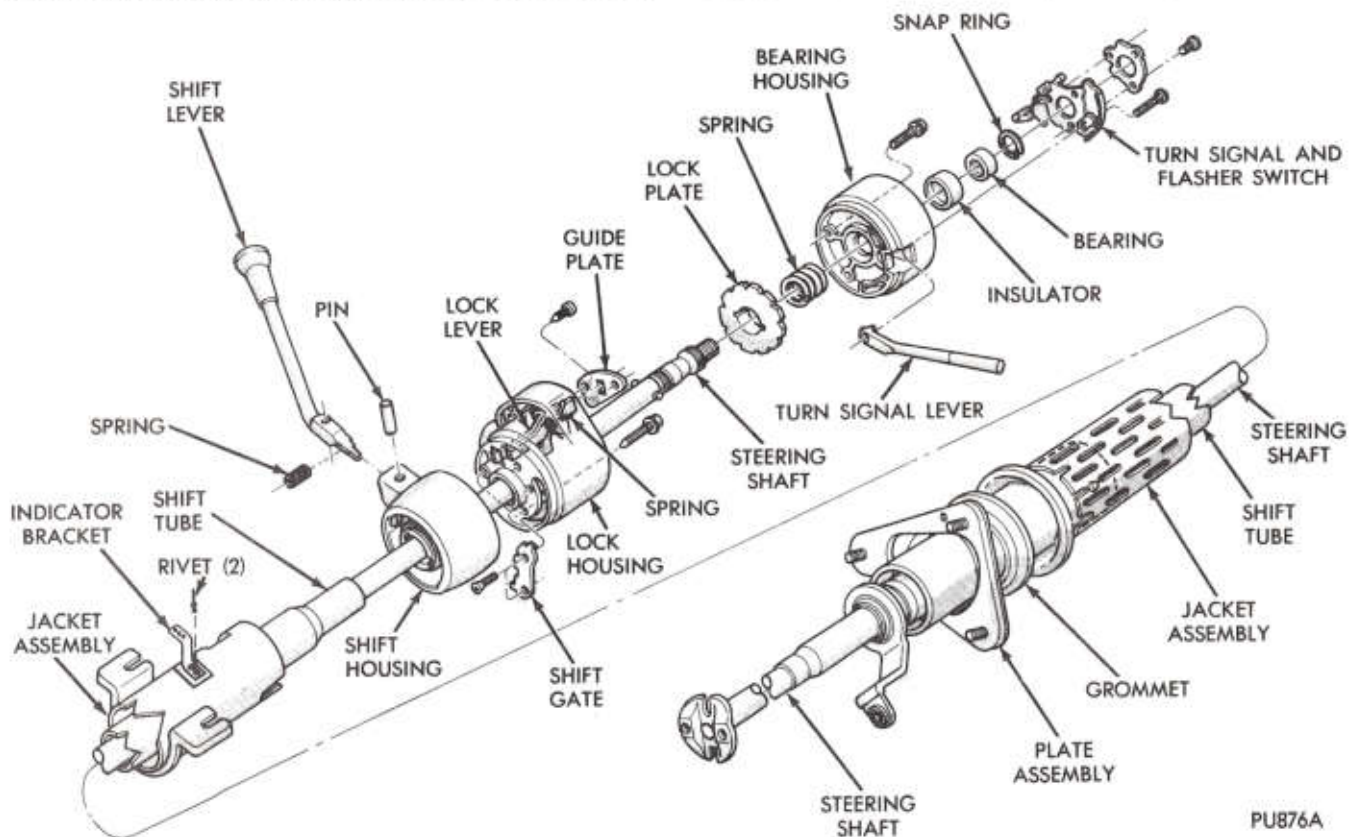
The steering shaft is a two-piece assembly. The upper piece is solid and has a double-flatted lower section. The lower piece is hollow and formed to fit over the double-flatted section of the upper piece. The purpose of the flatted section is to provide continued steering action even though completely telescoped. Plastic is injected through four holes in the hollow piece into a pair of annular grooves on the solid portion of the shaft. The four small holes filled with plastic form the shear pins. Upon impact, the shear pins break off and the shaft gradually telescopes against a resistance provided by the plastic collars in the annular grooves.

The mounting bracket is designed to restrain the column from being shifted toward the driver during

impact. It incorporates two "breakaway capsules" that allow the mounting bracket to slip off the attaching points, permitting the steering column to compress or yield in a forward direction under a severe impact from the driver side.

When the column is installed in a vehicle it is not susceptible to damage through ordinary usage. However, when it is removed, special care must be taken in handling this assembly. When the column is removed from the vehicle such actions as a sharp blow on the end of the steering shaft or shift levers, leaning on the column assembly, or dropping of the assembly could shear or loosen the plastic shear joints or rivets that maintain column rigidity. Therefore, it is suggested that the removal and installation, and the disassembly and reassembly procedures be carefully followed when servicing this assembly.

CAUTION: Bumping, jolting, and hammering on the steering shaft and gearshift tube must be avoided during all servicing operations. If the shear pins are broken, the controlled length of the telescoping features will be changed making these parts unfit for further use. If steering shaft or gearshift tube are damaged, they cannot be repaired; they must be replaced. The Special Tools required and their usage are covered in the following service procedures.



PU876A

Fig. 2—Steering Column (Column Shift)

SERVICE PROCEDURES

COLUMN

Removal

- (1) Disconnect negative (ground) cable from battery.
- (2) On vehicles equipped with column shift, disconnect link rod by prying rod out of grommet in shift lever (Fig. 3).
- (3) Remove steering shaft lower coupling to wormshaft roll pin.
- (4) Disconnect wiring connectors at steering column jacket.
- (5) Remove steering wheel center pad assembly.
- (6) Disconnect horn wire and remove horn switch, (if applicable).
- (7) Remove steering wheel retaining nut. Remove steering wheel with Tool C-3428B. **Do not bump or hammer on steering shaft to remove wheel.**
- (8) Remove turn signal lever (Fig. 4).
- (9) Remove floor plate to floor pan attaching nuts.
- (10) To expose steering column bracket (See "Electrical" Group 8).
- (11) Remove panel lower reinforcement.
- (12) Disconnect "PRND21" cable from bracket on

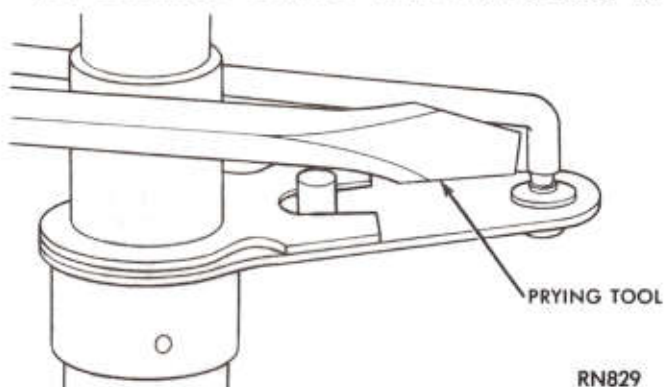


Fig. 3—Prying Rod out of Grommet

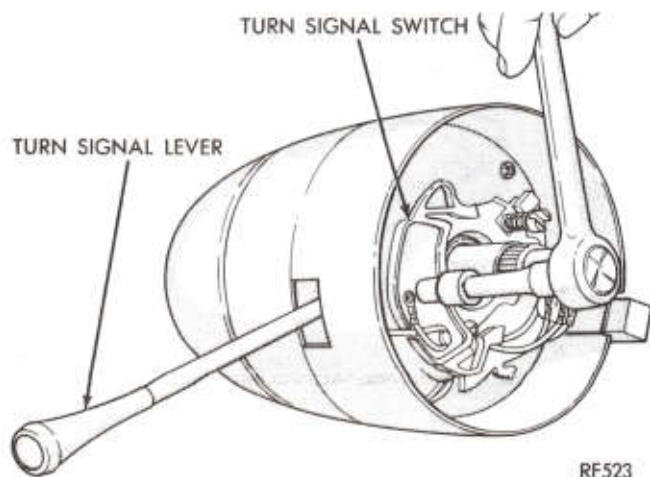


Fig. 4—Turn Signal Lever

column.

(13) Remove nuts attaching steering column bracket to instrument panel support.

(14) Carefully remove lower coupling from steering gear wormshaft, then remove column assembly out through passenger compartment being careful not to damage paint or trim.

(15) Install **new** grommet from rod side of lever, using pliers and backup washer to snap grommet into place (Fig. 5). Use MOPAR Multipurpose Grease, Part Number 4318063 or equivalent, to aid installation of grommet. **New grommet should be used whenever rod is disconnected from lever.**

Disassembly

(1) Pry out wiring trough retainers and lift off wiring trough. New retainers may be required for reassembly (if applicable).

(2) To remove shift lever, use masking tape to protect paint and a deep socket to back up the housing then drive the retaining roll pin out with a punch.

(3) Secure steering column in a vise by clamping at the column bracket. Do not distort column.

(4) Remove turn signal switch and upper bearing retainer screws. Remove retainer and lift switch upward out of the way (Fig. 6).

(5) Remove retaining screw and lift the ignition key lamp assembly out of the way (Fig. 7).

Steering Shaft

(1) Remove snap ring from upper end of steering shaft (Fig. 8).

(2) Remove three screws which hold bearing housing to lock housing (Fig. 8).

CAUTION: These screws must be removed before steering shaft removal.

(3) Remove bearing housing from shaft.

(4) Remove coil spring.

(5) Remove lock plate from shaft.

(6) Remove shaft through lower end of column.

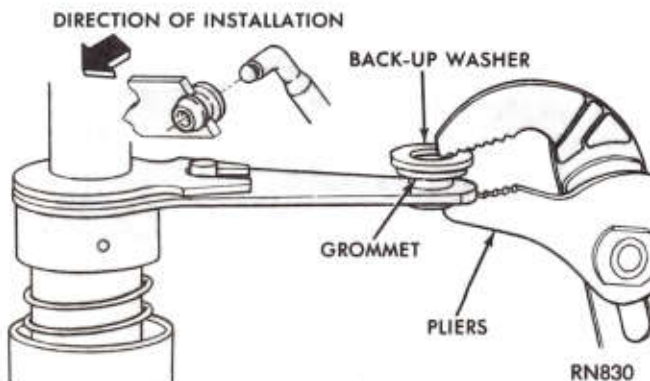


Fig. 5—Install New Grommet

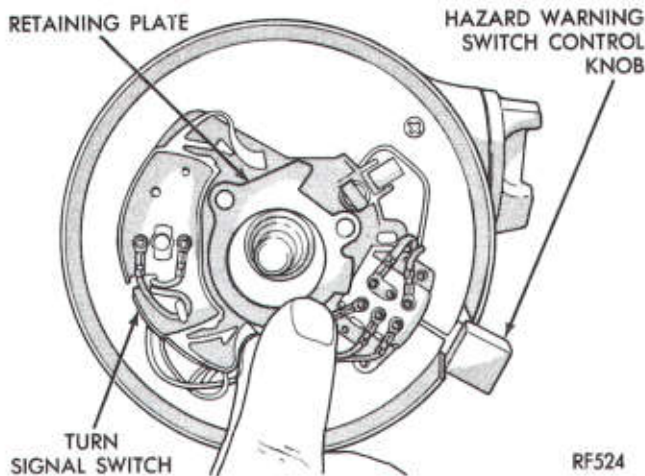


Fig. 6—Retainer and Turn Signal Switch

Lock Housing

(1) Remove two retaining screws and the lock lever guide plate which will expose the lock cylinder release hole (Fig. 9)

(2) Place cylinder in LOCK position and remove key.

(3) Insert a small diameter screwdriver or similar tool into lock cylinder release hole and push in to release spring loaded lock retainer. At the same time pull lock cylinder out of housing bore (Fig. 10).

(4) Remove the three retaining screws and the ignition switch assembly (Fig. 8).

(5) Grasp lock lever and spring assembly and pull straight out of housing (Fig. 11).

(6) Remove four lock housing to column jacket hex-head retaining screws and remove housing from

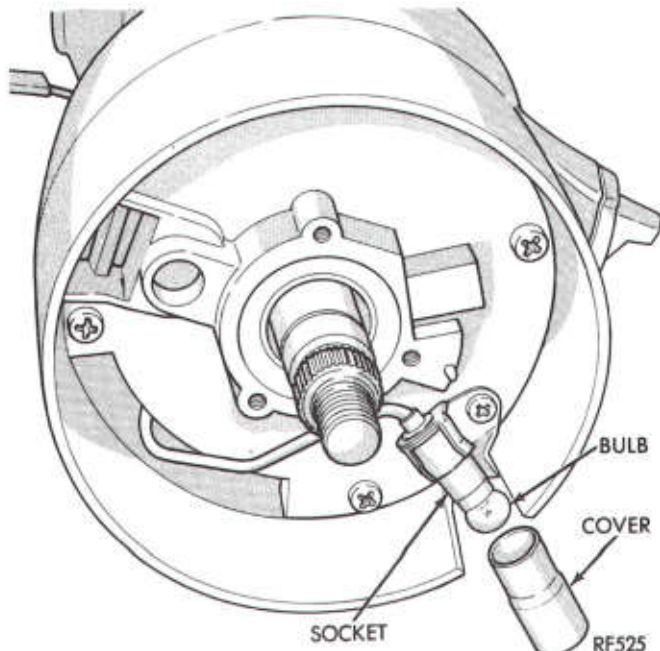


Fig. 7—Ignition Key Lamp

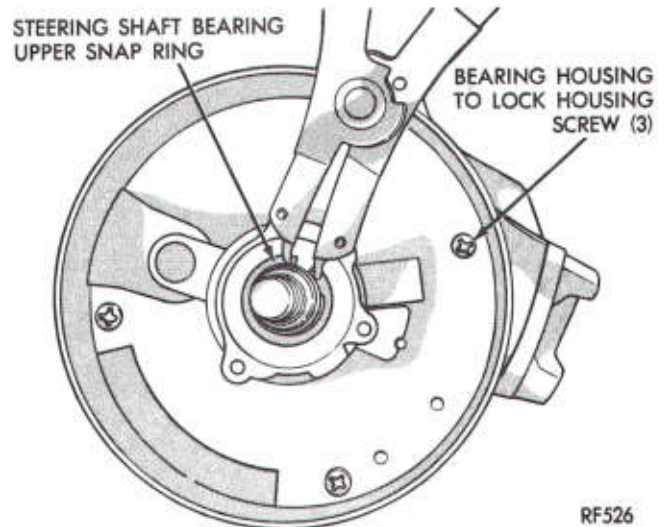


Fig. 8—Bearing Upper Snap Ring

jacket (Fig. 12).

Shift Tube (Figs. 13 and 14)

(1) To remove shift tube from column shift models, loosen shift tube set screw in shift housing (Fig. 13). Remove shift tube through the lower end of the jacket.

(2) Remove floor plate and grommet from jacket.

Steering Shaft Coupling (Flexible) (Fig. 15)

Removal

- (1) Remove 4 bolts and two cross straps.
- (2) Remove flexible coupling.

Inspection

Check flexible coupling for cracks or deterioration. Check cross straps for warpage or distortion. Replace those parts no longer serviceable.

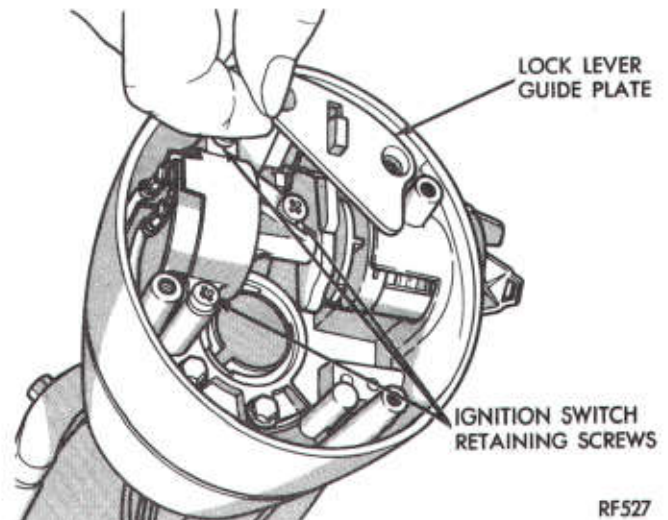


Fig. 9—Lock Lever Guide Plate

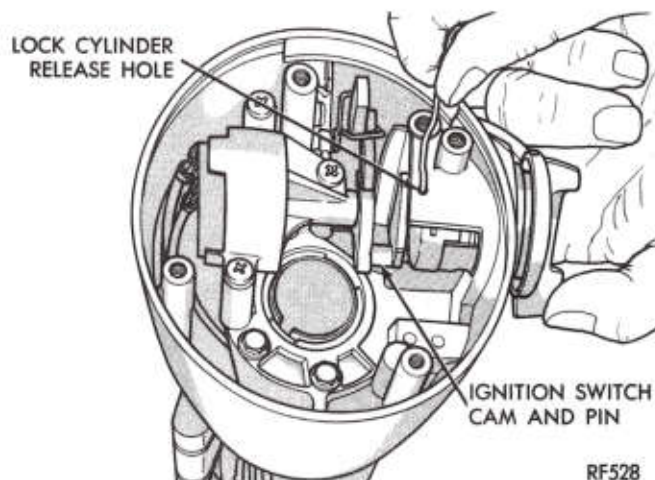


Fig. 10—Remove Lock Cylinder

Reassembly

- (1) Position the flexible coupling to the two cross straps.
- (2) Insert 4 bolts (Note position of "Long" and "Short" bolts Fig. 15).
- (3) Place coupling assembly on the flanges making sure that the master spline on steering shaft lines up with the master spline in lower pot coupling during assembly.
- (4) Torque bolts to 200 in. lbs. (23 N·m).

Steering Shaft Pot Coupling (Fig. 16)**Removal**

- (1) Pry cover tangs out from coupling body and lift seal and cover from body.
- (2) Drive the small, short dowel pin at edge of coupling body, down into coupling and discard. A new pin will be required for reassembly.
- (3) Pull body off the shaft and shoe assembly.
- (4) Separate and clean all parts.

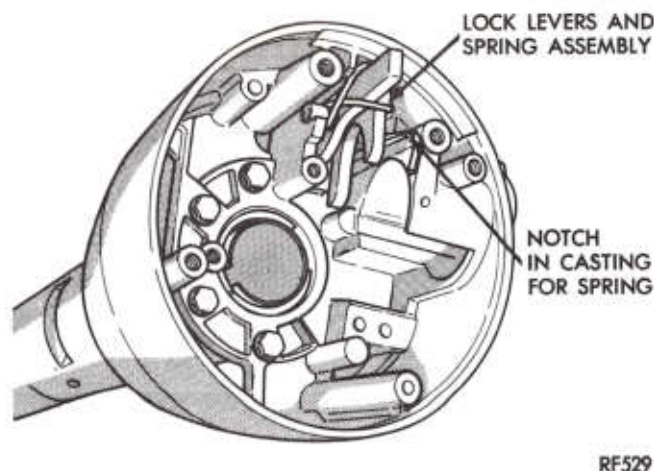


Fig. 11—Lock Levers and Spring Assembly Installed

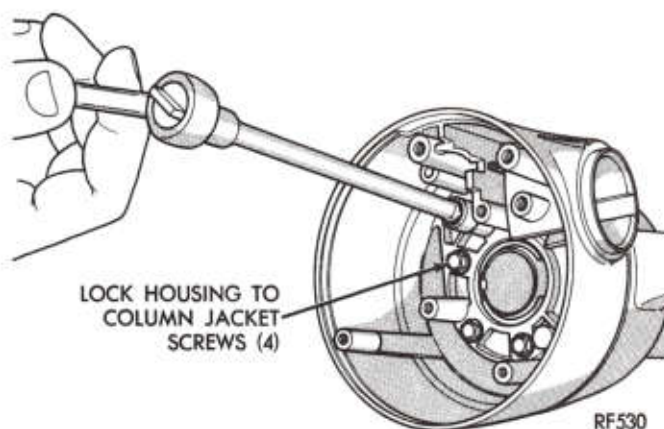


Fig. 12—Lock Housing Retaining Screws

Column Inspection

After cleaning, inspect all parts for wear or damage. Inspect turn signal switch for distortion, broken or damaged parts. Inspect wiring insulation for worn or bare spots.

Inspect steering shaft bearings for smooth operation, and lubricate with Multipurpose Grease NLGI Grade 2 E.P. If bearing has any signs of roughness or wear, it should be replaced.

Inspect floor plate grommet and replace if damaged.

Reassembly (Figs. 1 or 2)

During reassembly, apply a thin coat of Multipurpose Grease NLGI Grade 2 E.P., such as Multi-mileage Lubricant, Part Number 4318062, or equivalent, to all friction surfaces.

(1) Clamp column in a vise so that both ends of column are accessible.

(2) Check column tube-to-mandrel rivets for tightness. Replace if necessary, using 1/8 inch diameter by 1/4 inch long (1/8 inch grip) steel "blind" rivets.

CAUTION: Do not use aluminum rivets.

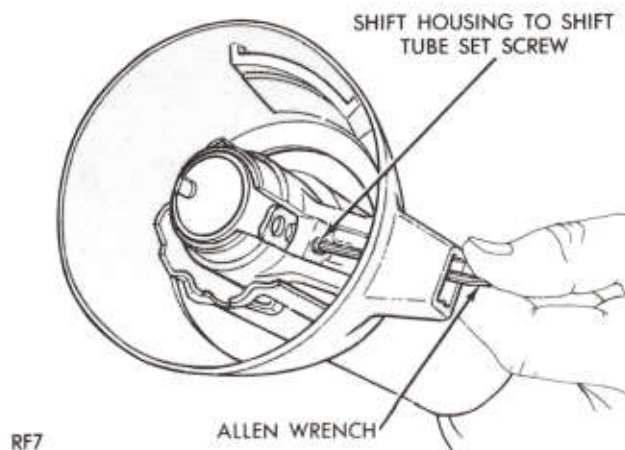


Fig. 13—Shift Tube Set Screw

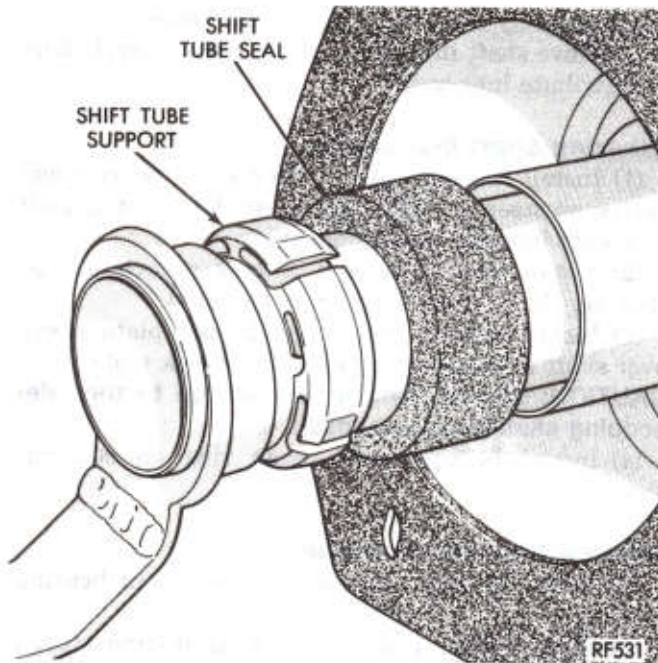


Fig. 14—Shift Tube Assembly

(3) Install the floor plate and grommet on lower end of column jacket. **This must be done before installing shift tube.**

(4) Column Shift Automatic Transmission:

(a) Position the gearshift housing on the column jacket.

(b) With dust seal and shift tube support installed on shift tube (Fig. 14), slide the assembly into jacket. Guide key on upper end of tube into slot in gearshift housing.

(c) Position the crossover load spring and shift lever in the gearshift housing and tap the pivot pin

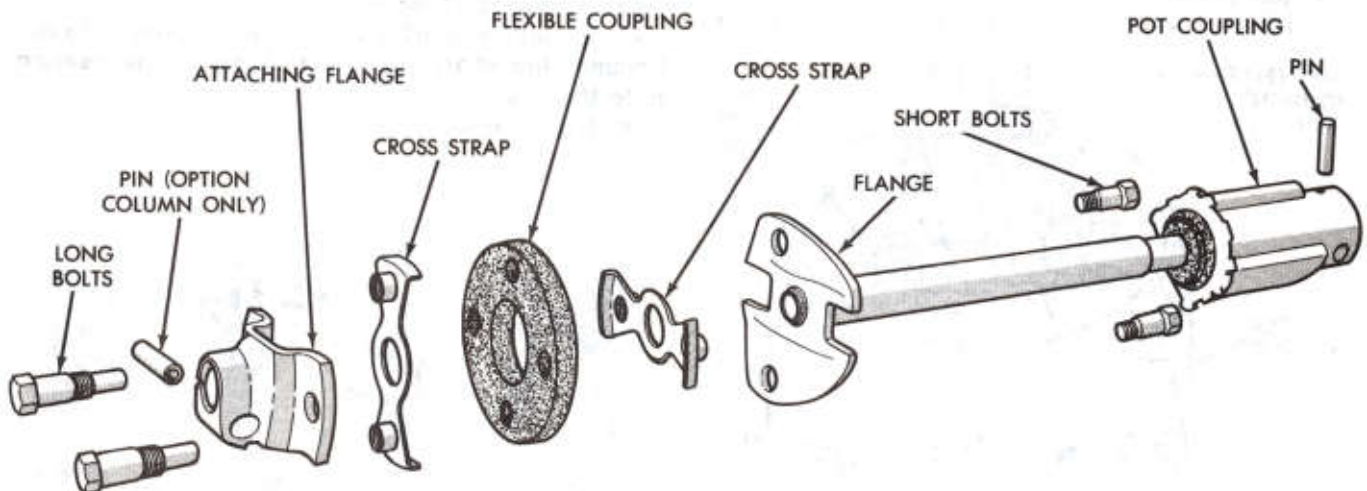


Fig. 15—Steering Shaft Flexible Coupling

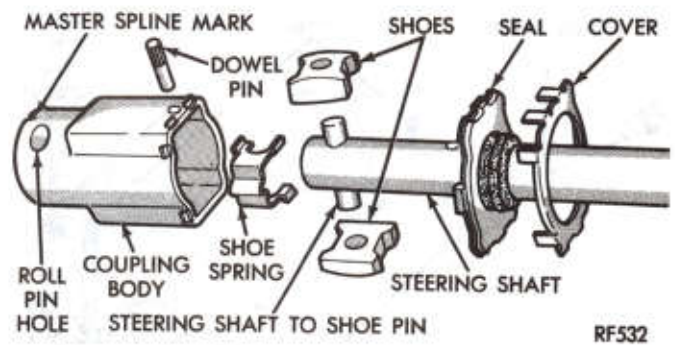


Fig. 16—Steering Shaft Pot Coupling

into place.

(d) Install the shift lever gate on the lock housing (Fig. 18).

(e) Placing the shift lever in midposition, seat the lock housing on top of the jacket, indexing the key in the housing with the slot in the jacket. Insert all four screws and tighten them alternately in steps to insure proper seating of the housing on the jacket. Tighten to 90 in. lbs. (10 N-m) (Fig. 12).

(5) Grease and assembly the two lock levers, lock lever spring, and pin (Fig. 19).

(6) Install the resulting assembly in the lock housing. Seat the pin firmly into the bottom of the slots. Make sure that the lock lever spring leg is firmly in place in lock casting notch (Fig. 11).

(7) Install the lock lever guide plate and retaining screws (Fig. 9).

(8) Position ignition switch to center detent (OFF position) and hand lever in PARK. Feed wires down through the space between housing and jacket. Position switch in housing and tighten three mounting screws (Fig. 9).

(9) **To install ignition lock, turn key to the LOCK**

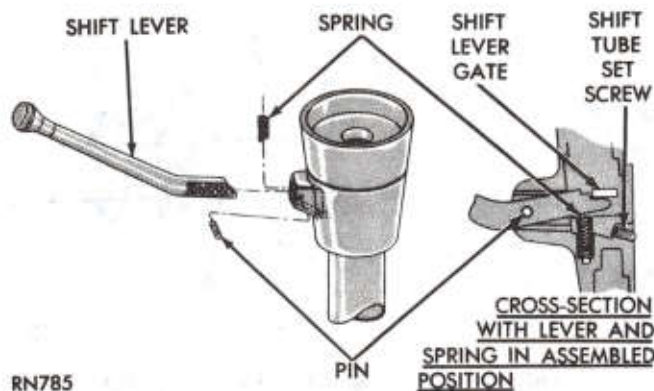


Fig. 17—Shift Lever Installation

position and remove key. The cylinder will move inward and a spring loaded retainer will snap into place, locking the cylinder into the housing.

Steering Shaft Coupling Assembly (Fig. 15)

- (1) Fill coupling body approximately 1/2 full with Multipurpose Grease, NLGI Grade 2 EP, such as MOPAR Parts Multimileage Lubricant, Part Number 4318062 or equivalent.
- (2) Place cover and seal on shaft.
- (3) Press shoe pin into steering shaft so that it projects an equal distance on each side of shaft.
- (4) Place spring on side of shaft, straddling the shoe pin.
- (5) Place shoes on pin ends with flat side toward spring, engaging tangs.
- (6) Squeeze shoes together, compressing spring, and push assembly into coupling body. Align master spline mark of coupling body with master spline on upper shaft.
- (7) Drive in a **new** dowel pin flush to outer surface of coupling body.
- (8) Position seal and cover on body and crimp cover

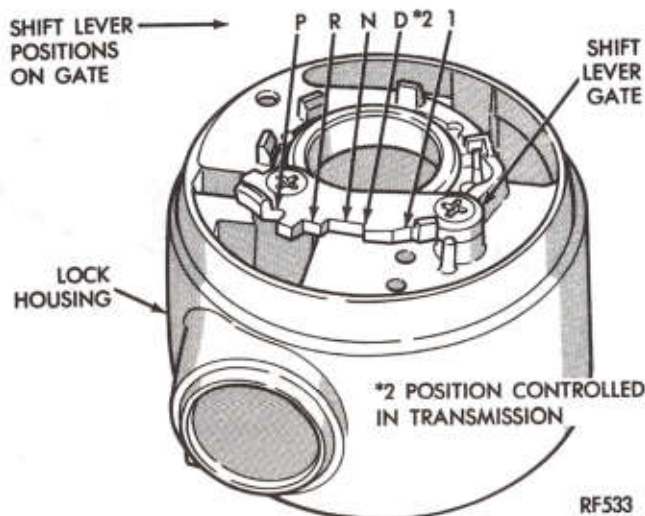


Fig. 18—Lock Housing and Shift Gate

tangs securely over the projections on body.

- (9) Move shaft in and out of pot body several times to distribute lubricant.

Steering Shaft Installation

- (1) Install bearing support (floor shift), bearing and spring on steering shaft and insert the steering shaft assembly into the column assembly.
 - (2) Install lock plate and a **new** groove pin on steering shaft. Make sure pin is centered.
 - (3) Install steering column shaft lock plate sleeve over shaft lock plate pin and against lock plate.
- CAUTION:** Do not hammer or damage to the telescoping shaft joint may result.
- (4) Install bearing lower snap ring on steering shaft.

Bearing Housing Assembly

- (1) Install ignition key lamp assembly in bearing housing.
- (2) Place rubber insulator with grounding staple, over column upper bearing and install assembly into bearing housing bore. Use a soap solution or rubber lubricant to ease installation.
- (3) Install the turn signal in bearing housing, feed the wires through the opening in housing. Feed ignition key lamp assembly wire through opening in housing at this time.
- (4) Install retaining plate over switch and tighten 3 screws to 27 in. lbs. (3 N·m).
- (5) Install turn signal lever or turn signal, speed control lever on turn signal switch. If speed control, feed the wires through opening provided in bearing housing.
- (6) Position bearing housing assembly on steering shaft, feeding the wires through the space between lower housing and jacket.
- (7) Install the bearing on the steering shaft. **Do not hammer the shaft into the bearing or the bearing onto the shaft.**
- (8) Install upper snap ring on shaft.

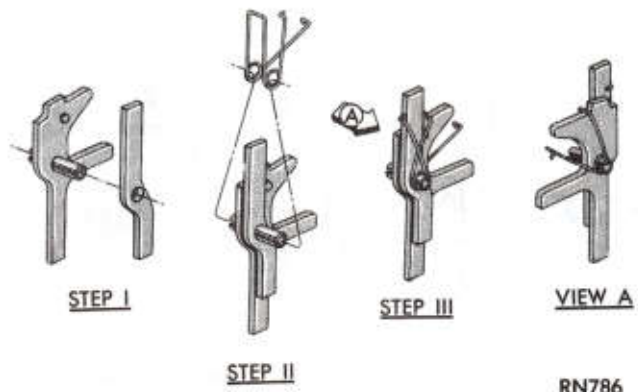


Fig. 19—Lock Levers and Spring Assembly

(9) Install 3 bearing housing to lock housing screws and tighten to 35 in. lbs. (4 N·m).

(10) Install the wiring trough in place over wires, being careful not to pinch wires between trough and jacket. Install new retainers if required.

Installation

(1) Install ground clip on left capsule slot (Fig. 20). Both plastic capsules should be installed in the bracket slots. Insert column assembly through floor pan opening, being careful not to damage paint or trim.

(2) With front wheels in straight ahead position and master splines on wormshaft and coupling aligned, engage coupling with wormshaft and install the roll pin. **CAUTION: Do not apply end loads to steering shaft.**

(3) Hold column assembly with bracket slots on mounting studs. Install but **do not tighten** the two upper bracket washers and nuts.

(4) After assuring that both capsules are fully seated in their slots in the column support bracket, tighten the two upper bracket nuts to 110 in. lbs. (12 N·m).

(5) Position floor plate over floor pan opening, centering it around the column, then install and tighten retaining bolts.

(6) Place steering wheel on steering shaft with master spines aligned. Install retaining nut and tighten to 45 ft. lbs. (61 N·m). **CAUTION: Do not drive wheel on shaft; draw wheel down with retaining nut.**

(7) Install horn switch parts previously removed from steering wheel. Connect horn switch wire.

(8) Connect wiring connectors at steering column jacket. Connect battery ground cable, test operation of lights and horns.

(9) Connect link rod to shift lever by snapping rod into grommet with pliers (Fig. 21). (Grommet must always be installed into lever before rod is inserted

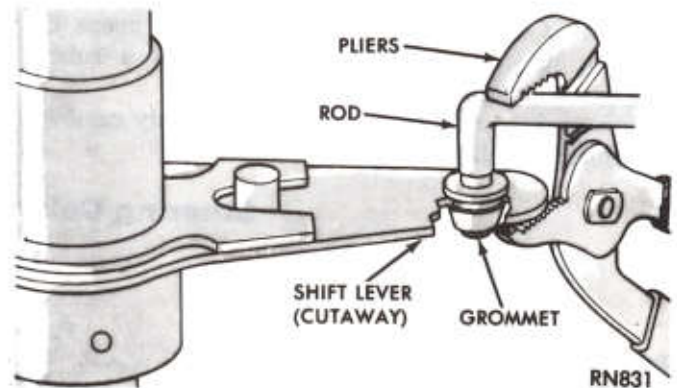


Fig. 21—Installing Rod into Grommet

into grommet.) Use MOPAR Multipurpose Grease 4318063, or equivalent, to aid installation.

(10) Readjust linkage. **Whenever the column is removed or loosened, linkage adjustment must be checked.** Refer to "Transmission Group" for linkage adjustment.

(11) Column shift automatic; connect gearshift "PRND21" cable to bracket on column, in its original location. Slowly move gearshift lever from "1" (low) to "P" (park) pausing briefly at each selector position. The indicator pointer must align with each selector position.

(12) Reinstall panel lower reinforcement bezel. See "Electrical" Group 8 for installation procedure.

(13) Connect negative (ground) cable to battery.

Floor Shift Column

The Steering Column used with a floor-mounted gearshift is basically the same as previously described. Standard columns and service procedures are identical except as described below.

After lock housing is removed it will be seen there is no shift tube or set screw in this shift housing.

Instead, this shift housing has a spring attached

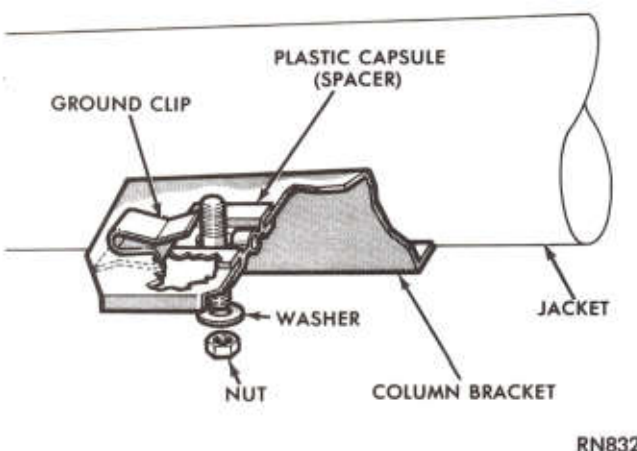


Fig. 20—Ground Clip and Plastic Spacer

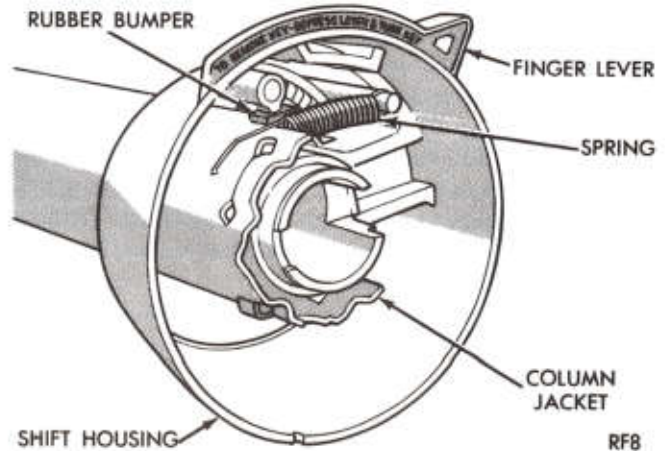


Fig. 22—Floor Shift Column

between it and the column jacket which keeps the housing rotated counterclockwise against a rubber bumper (Fig. 22).

This spring and rubber bumper are easily removed or replaced with the fingers.

The lower steering shaft bearing is mounted in an aluminum support.

For Removal of horn switch, See Group 8—Electrical

Steering Column (TILT-WHEEL)

INDEX

	Page		Page
General Information	34	Steering Wheel:	
Steering Column	34	Installation	39
Disassembly	34	Removal	39
Inspection	37	Tightening Reference	40

GENERAL INFORMATION

Safety goggles should be worn at all times when working on steering columns.

The tilt-wheel steering columns are optional equipment.

These steering columns have an impact absorbing

design utilizing two telescoping tubes. The installation is essentially the same as the standard columns, therefore only the disassembly and reassembly of the column will be detailed here.

SERVICE PROCEDURES

COLUMN

Removal (See Standard Columns)

Disassembly (Fig. 1)

- (1) Remove four bolts attaching bracket assembly to column jacket.
- (2) Remove the wiring protector from column jacket.
- (3) Attach column Holding Fixture C-4132 to jacket.
- (4) Mount column in vise with holding fixture.
- (5) Remove tilt lever and turn signal lever or speed control lever (see "Electrical—Group 8). Push hazard warning knob in and unscrew to remove. Remove ignition key lamp assembly (Fig. 2).
- (6) Move tilt mechanism to full down tilt.
- (7) Carefully remove plastic cover from lock plate. Depress lock plate or canceling cam retainer, with finger and pry remaining ring out of groove with screwdriver (Fig. 3). Tool C-4156 and C-4156-2 can be used (Fig. 4) but the full load of the upper bearing spring should not be relieved as the retaining ring will turn easily making removal more difficult. Remove lock plate or canceling cam retainer, canceling cam, and upper bearing spring.
- (8) Remove three turn signal switch attaching screws, place shift bowl in low (1) position. Wrap a piece of tape around the connector and wires to prevent snagging when removing the switch (Fig. 5). Remove switch and wiring (Fig. 1).
- (9) The lock cylinder may be removed in any posi-

tion from ACCESSORY to ON. However, the LOCK position is recommended because of its positive location.

Insert a thin tool (small screwdriver or shim stock) into the slot next to the switch mounting screw boss (right-hand slot) and depress spring latch at bottom of slot, which releases lock. Remove lock (Fig. 6).

(10) Remove 3 housing cover screws and remove housing cover.

(11) Reinstall tilt release lever and place column in full "up" position. Remove tilt spring retainer using a large Phillips screwdriver. Insert screwdriver in opening, press in approximately 3/16 inch; turn approximately 1/8 turn counterclockwise until ears align with grooves in housing and remove spring and guide (Fig. 7).

(12) Push the upper steering shaft in sufficiently to remove steering shaft inner race seat and inner race.

(13) With ignition switch in ACCESSORY position, remove the ignition switch mounting screws and ignition switch (Fig. 8).

(14) Place pivot pin remover C-4016 over pivot pin and thread small portion of screw firmly into the pin. Hold screw from turning with one wrench, turn nut clockwise with a second wrench to withdraw pivot pin from the support (Fig. 9). Remove opposite pivot pin in same manner.

(15) Use tilt release lever to disengage lock shoes. Remove bearing housing assembly by pulling upward to extend rack fully. Move housing assembly to the

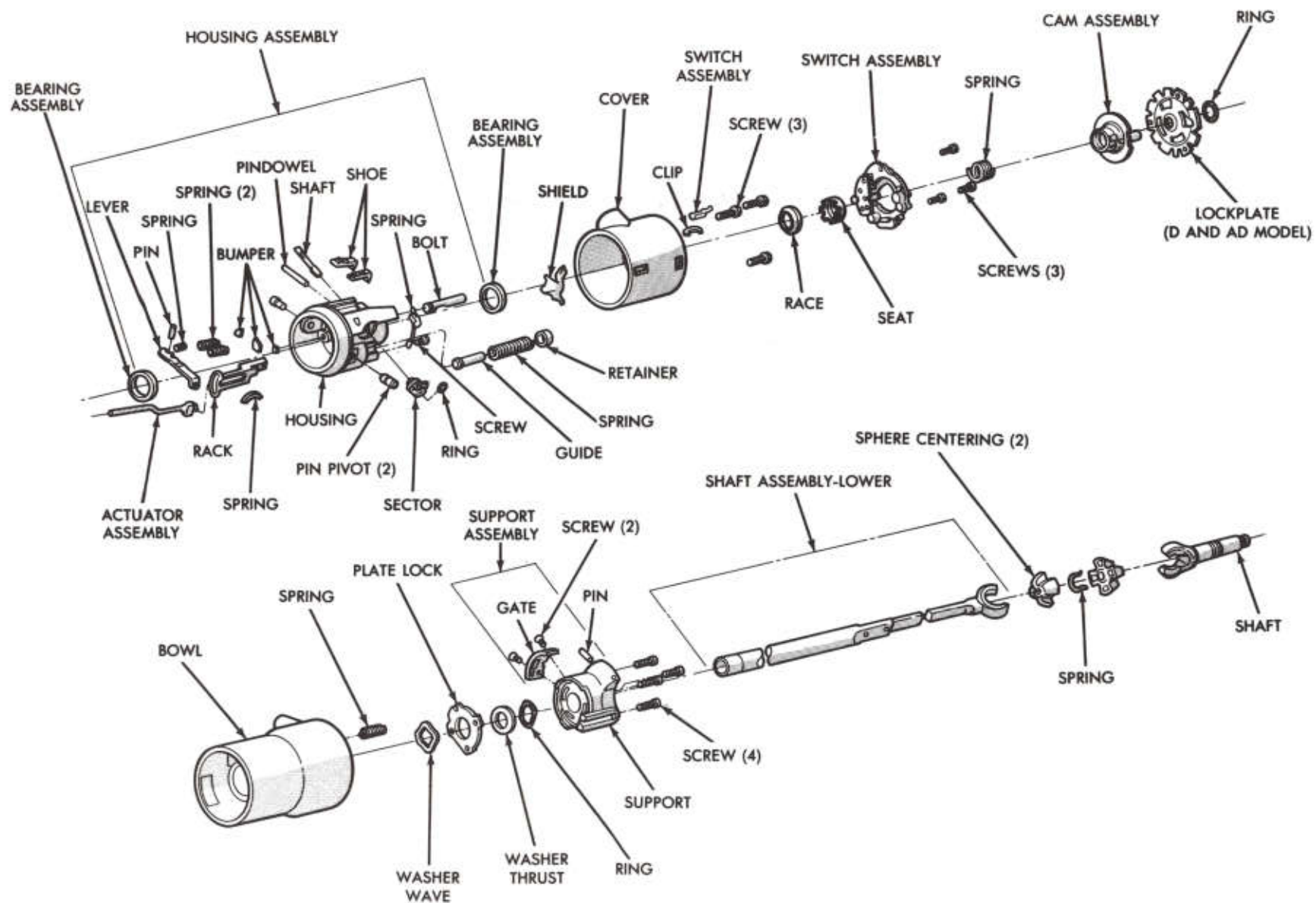


Fig. 1—Tilt-Wheel Column Upper End

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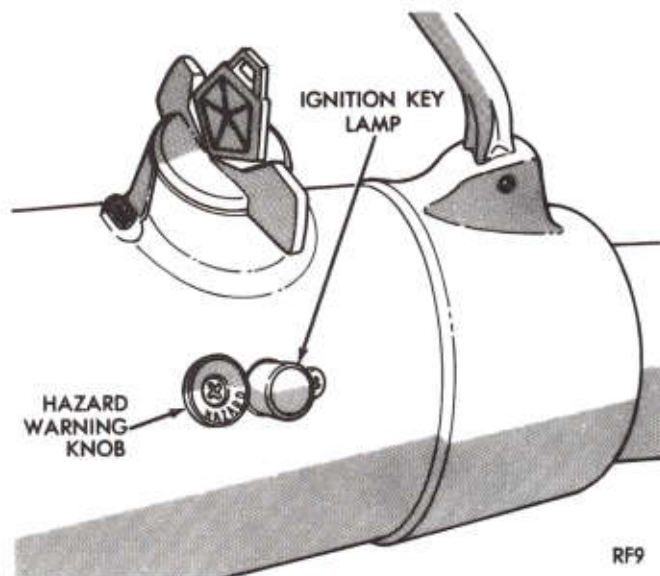


Fig. 2—Ignition Key Lamp

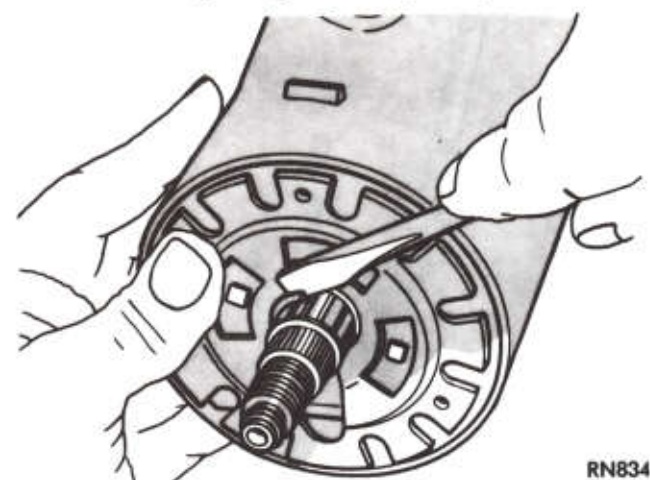


Fig. 3—Lock Plate Retaining Ring

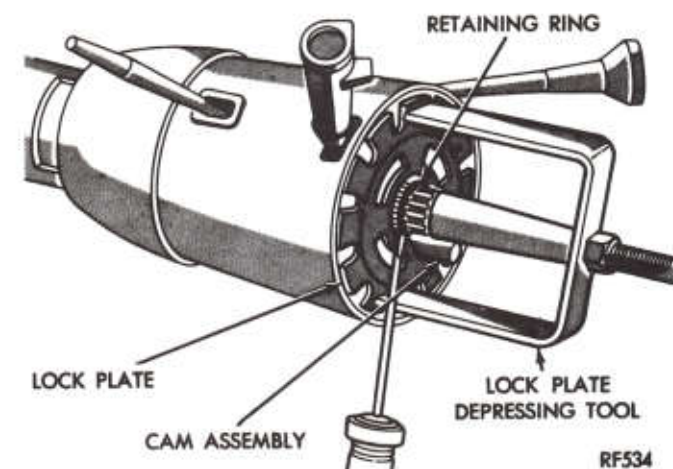


Fig. 4—Removing Lock Plate Retaining Ring with Special Tool

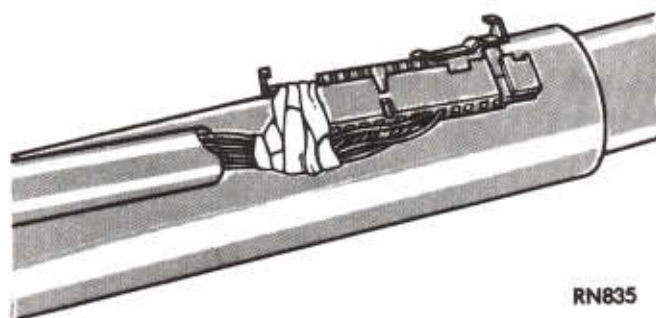


Fig. 5—Tape Connector and Wires

left to disengage rack from actuator. Remove activator assembly.

(16) Remove coupling from lower end of steering shaft. Double coupling is retained to shaft with a roll pin.

(17) Remove steering shaft assembly from upper end.

(18) Disassemble steering shaft assembly by removing center spheres and anti-lash spring (Figs. 10 and 11).

(19) Remove four bolts securing support to lock plate and remove support from end of column jacket. If necessary, remove two attaching screws and shift gate from the support.

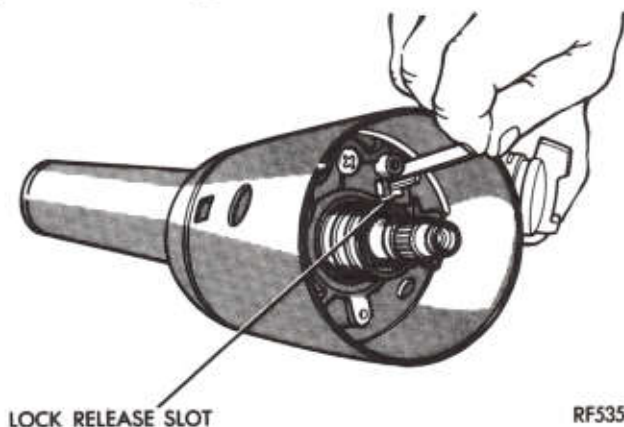


Fig. 6—Removing Lock Cylinder

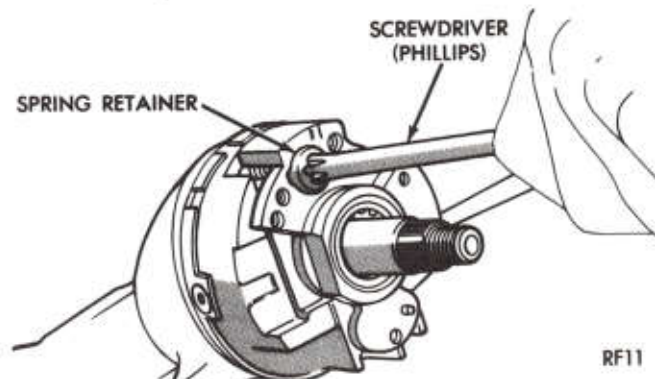


Fig. 7—Tilt Spring Retainer

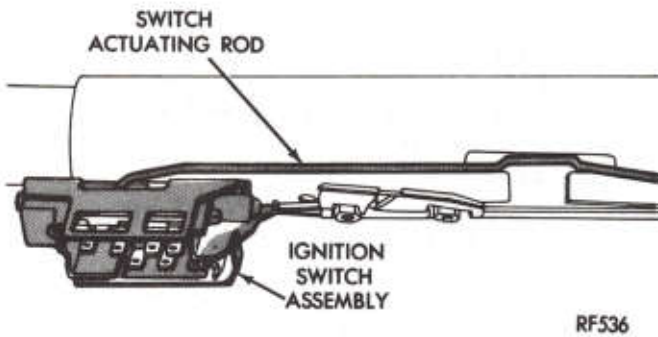


Fig. 8—Ignition Switch

(20) Remove shift tube retaining ring with screwdriver. Remove thrust washer.

(21) Using a small screwdriver carefully disengage the plastic shift tube support from the lower end of the jacket.

(22) Remove shift tube from bowl using Tool C-4120 (Fig. 12). Insert bushing on end of tool in shift tube and force tube out of bowl. **Do not hammer or pull on lower or upper shift tube because plastic joint may be sheared.**

(23) Remove shift tube from jacket from lower end.

(24) Remove lock plate by sliding out of jacket notches and tipping down toward bowl hub at the 12 o'clock position and under jacket opening. Remove wave washer.

(25) Remove bowl from jacket. Remove shift lever spring from bowl by winding spring up with pliers and pulling out.

Bearing Housing Disassembly (Fig. 1)

(1) Remove tilt lever opening shield from housing.

(2) Remove lock bolt spring by removing spring retaining screw and moving spring clockwise to remove from bolt (Fig. 13).

(3) Remove snap ring from sector driveshaft. With a small hammer and small punch, lightly tap driveshaft from sector. Remove shaft, sector, and bolt. Remove rack and rack spring (also shim if one is used).

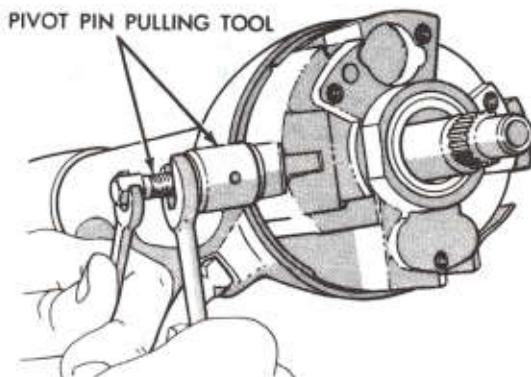


Fig. 9—Pivot Pin Removing Tool

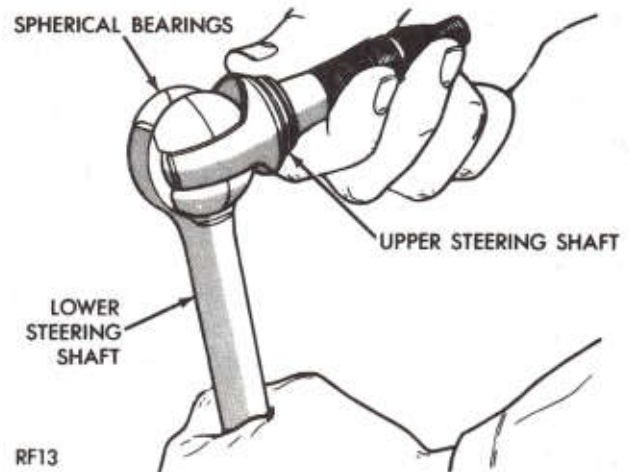


Fig. 10—Assembling or Disassembling Steering Shaft Centering Spheres

(4) Remove tilt release lever pin with punch and hammer. Remove lever and release lever spring. (To relieve load on release lever, hold shoes inward and wedge block between top of shoes (over slots) and bearing housing).

(5) Remove lock shoe pin with punch and hammer. Remove lock shoes and lock shoe springs.

(6) Remove bearings from bearing housing **only if they are to be replaced**. Remove separator and balls from bearing. Place housing on work surface. With a pointed punch against back surface of race, carefully hammer race out of housing until bearing puller can be used. Repeat for other race. Do not reuse bearings.

Bearing Housing Inspection

(1) Inspect all bearings and race seats for brinelling, nicks, scratches and wear.

(2) Inspect centering sphere for nicks, damage or wear. If damage is found, check shaft couplings for nicks, burrs or rough spots.

(3) Inspect actuator housing, shift lever bowl, and

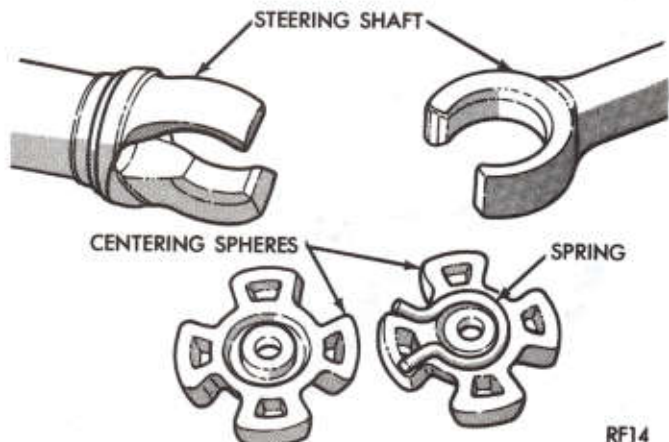


Fig. 11—Shaft Centering Spheres

support for cracks or other damage.

(4) Inspect turn signal switch unit for distortion, broken or damaged parts.

(5) Inspect horn and turn signal wires for worn or bare spots.

(6) Inspect the steering shaft and gearshift tube for loose or broken plastic shear joints.

Assembly

The grease recommended for use during reassembly procedures is Multipurpose Grease NLGI Grade 2 E.P. Such as Multimileage Lubricant, Part Number 4318062, or equivalent.

Bearing Housing Assembly (Fig. 1)

(1) Install bearing in bearing housing, if removed.

(2) Install lock shoe springs, lock shoes and shoe pin in bearing housing. Use approximately .180 inch rod to line up shoes for pin installation.

With tilt lever opening on left side, shoes facing up, the four slot shoe is on the left.

(3) Install spring, release lever and pin in bearing housing. (Again, relieve load on release lever as in step (4) of disassembly procedure.)

(4) Install shaft in housing. Lightly tap sector onto the shaft far enough to install snap ring.

(5) Install lock bolt and engage with sector cam surface.

(6) Install rack and spring. Block tooth on rack to engage block tooth on sector. Install external tilt release lever.

(7) Install bolt spring and spring retaining screw. Tighten to 35 in. lbs. (4 N·m) (Fig. 13).

(8) Install shift lever spring in bowl by winding up with pliers and pushing in. Slide bowl into jacket.

(9) Install wave washer and lock plate in place. Work lock plate into notches in jacket by tipping lock plate toward bowl hub at 12 o'clock position and under jacket opening. Slide lock plate into notches in jacket.

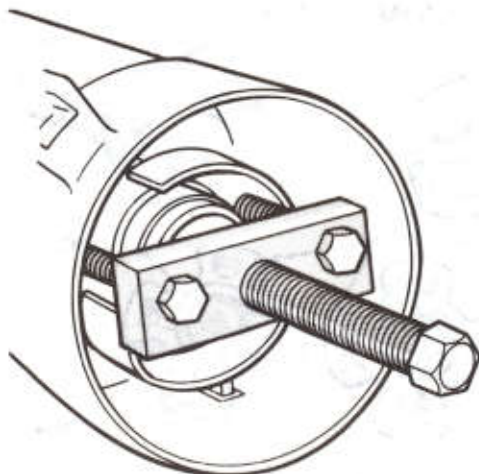


Fig. 12—Remove Shift Tube from Bowl

(10) Carefully install shift tube in lower end of jacket. Align key in tube with keyway in bowl and use Tool C-4119 to pull shift tube into bowl (Fig. 14).

CAUTION: Do not push or tap on end of shift tube. Install thrust washer and retaining ring by pulling bowl up to compress wave washer.

(11) Insert support by aligning "V" in support with "V" notch in jacket. Insert screws through support into lock plate. Tighten screws to 60 in. lbs. (7 N·m).

(12) Reinstall lower bearing, if removed, in the lower end of shift tube. Locate approximately 3/16 inch inside of tube (use a soap solution or rubber lubricant to ease installation).

(13) Install centering spheres and anti-lash spring in upper steering shaft (Fig. 10). Install lower steering shaft from same side of spheres that spring ends protrude.

Make a trial assembly of the double-coupling assembly to assure that the master serration of the upper shaft will align with the master serration of the pot coupling.

(14) Place housing in full "up" position and install guide, tilt spring, and tilt spring retainer using screwdriver in retainer slot. Turn retainer clockwise to engage.

(15) Install steering shaft assembly in shift tube from upper end. Carefully guide shaft through shift tube and bearing.

(16) Install ignition switch actuator rod through bowl from bottom and insert in slot in support. Extend rack downward from bearing housing. Assemble bearing housing over steering shaft and engage rack over end of actuator rod.

(17) Install external tilt release lever and, holding lock shoes in disengaged position, assemble bearing housing over steering shaft until the pivot pin holes line up and install pivot pins.

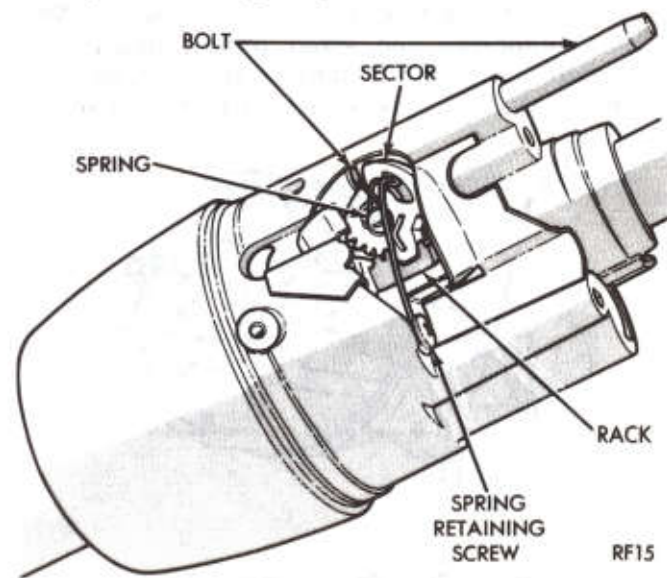
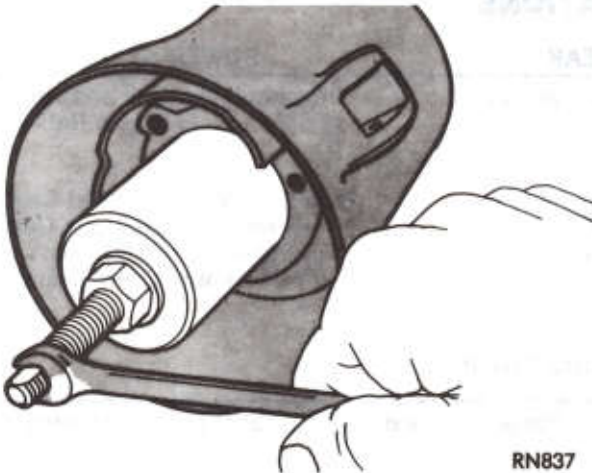


Fig. 13—Sector and Bolt Spring



RN837

Fig. 14—Installing Shift Tube

(18) Place housing in full "up" position, install guide after making sure there is grease between the guide and peg on support, tilt spring, and tilt spring retainer. Then, using screwdriver in retainer slot, turn retainer clockwise to engage (Fig. 7).

(19) Install bearing inner race and seat.

(20) Install tilt lever opening shield in position.

(21) Remove tilt release lever. Install housing cover and tighten three screws to 100 in. lbs. (11 N·m).

(22) Install signal switch wires and connector through cover, bearing housing and bowl. Push hazard warning plunger in, install switch and tighten screws to 25 in. lbs. (3 N·m).

(23) Install hazard warning knob and pull knob out. Install cancelling cam spring, cancelling cam (carrier assembly) and shift lock plate.

(24) Using Tool C-4156, depress shift lock plate and install a new retaining ring. (Fig. 4).

(25) Reinstall tilt release lever and turn signal switch lever (For Speed Control, see "Electrical" Group 8).

(26) **To install ignition lock, turn key to LOCK position and remove key.** Insert cylinder into housing far enough to contact switch actuator. Press inward and move switch actuator rod up and down to align parts. When parts align, the cylinder will move inward and a spring loaded retainer will snap into place, locking the cylinder into the housing.

(27) When replacing ignition switch, position the key cylinder in ACCESSORY detent. (Full counter-clockwise) Then place the switch in ACCESSORY by the following procedure:

(a) Spring loaded position at one end is START.

(b) Move the slider to the extreme other end, this is ACCESSORY.

(28) Fit the actuator rod into the slider hole and assemble loosely to the column with two screws. Push the switch lightly down the column (away from the steering wheel), to take out lash in the actuator rod, and tighten mounting screws. Caution should be exercised to prevent moving switch out of detent. Use only the correct length screws. Tighten to 35 in. lbs. (4 N·m).

(29) Install wire protector over wires on column jacket. Be careful not to pinch any wires.

(30) Remove column from vise.

(31) Remove holding fixture from column. Position bracket assembly on steering column. Install and tighten the four bolts to 120 in. lbs. (14 N·m)

(32) Align master splines and install the coupling assembly on steering shaft. Then drive in the retaining roll pin.

Installation (See Standard Columns)

Steering Wheel

Removal

(1) Push pad out of wheel through access holes in back of the wheel. **Do not pry pad off.** Remove horn wire.

(2) Remove steering wheel retaining nut. Remove steering wheel with Tool C-3428B.

CAUTION: Do not bump or hammer on steering shaft to remove wheel.

Installation

(1) Install steering wheel with master serration in hub aligned with missing spline tooth on end of steering shaft. Install and tighten retaining nut to 45 ft. lbs. (61 N·m).

(2) Attach horn wire to switch terminal, align switch blocks with clips and push pad into place.

SPECIFICATIONS

	MANUAL GEAR	POWER GEAR
Type	Recirculating Ball and Nut	Recirculating Ball and Nut
Gear Ratio	24 to 1	16.2-20:1 (Variable Ratio)
Arm Length (Inches)	6.0	
Worm Bearing Preload to Keep Wormshaft Moving	5 to 8 Inch-Pounds	4 to 5 Inch-Pounds (Old Gear) 4 to 8 Inch-Pounds (New Gear)
Gear Lash—Inch-Pounds	16 Maximum	14 Maximum (Old Gear) 18 Maximum (New Gear)
(Includes Worm Bearing Preload and Sector Gear Mesh)		

POWER STEERING PUMP**Model**—Saginaw Constant Displacement**Pump Pressure**—1200-1300 psi (8274-8963 kPa)**TIGHTENING REFERENCE****MANUAL STEERING**

	Foot Pounds	Newton Meters		Foot Pounds	Newton Meters
Sector Shaft Adjusting Screw Lock Nut	35	47	Gear Assembly to Frame Bolt	100	136
Sector Shaft Cover Bolt	25	34	Steering Arm Nut	175	237
			Steering Wheel Nut	45	61

POWER STEERING

	Foot Pounds	Newton Meters		Foot Pounds	Newton Meters
Gear Housing to Frame Bolt or Nut	100	136	Steering Arm Nut	175	237
Sector Shaft Adjusting Screw Lock Nut	28	38	Housing Head Spanner Nut	200	271
Sector Shaft Cover Nut	150	203	Valve Body Attaching Bolts	8	11
			Valve Body End Plug	50	68

PUMP

	Foot Pounds	Newton Meters		Foot Pounds	Newton Meters
High Pressure Hose Fitting			Bracket Bolts	35	47
Gear End (All Models)	32	43	Flow Control Valve Plug	4	5
Pump End (All Models)	32	43	Bracket Mounting Bolts	30	41

STEERING COLUMN

	Foot Pounds	Newton meters		Inch Pounds	Newton meters
Steering Wheel to Steering Shaft Nut (Standard)	45	61			
Steering Wheel to Steering Shaft Nut (Tilt-Wheel)	45	61			
Column Bracket to Column Support Stud	20	2			
Column Clamp Stud Nut, Bracket to Instrument Panel Support	110	12			
Flexible Coupling Bolts	200	23			
Support Plate Bolts	60	7			

TRANSMISSION

CONTENTS

	Page		Page
NP2500 OVERDRIVE 5-SPEED	1	TIGHTENING REFERENCE	119
FOUR SPEED:		TRANSFER CASE	
NP435	29	NP205	100
OVERDRIVE-4	16	NP241	105
LOADFLITE TRANSMISSIONS	35		
SPECIFICATIONS	116		

MANUAL TRANSMISSION NP2500 OVERDRIVE 5-SPEED

INDEX

	Page		Page
General Information	1	Countershaft Gear End Play	15
Service In Vehicle		Disassembling Transmission	2
Extension Housing Yoke Seal	15	Extension Housing Bushing Replacement	15
Gearshift Lever	2	Gear Set—Recondition	8
Service Out of Vehicle		Select Shim Chart	13
Assembling Transmission	7	Specifications	116
Cleaning and Inspection	16	Tightening Reference	119

GENERAL INFORMATION

The Chrysler Motors designed and built NP2500 fully-synchronized manual transmission is designed specifically for light-duty truck applications and incorporates an overdrive 5th gear for improved highway fuel economy. The light-weight, die-cast aluminum case and extension contain a full helical gear set, including reverse.

SAE 10W-30 engine oil is used for lubrication to improve durability and provide quiet operation. Additional durability improvements include; tapered roller bearings on the countershaft gear, caged needle bearings on first and reverse speed gears, and sealed ball bearings on the mainshaft and input shaft (drive pinion).

A new, single-unit top-mounted shifter, along with a 3-rail shift system, optimize shift effort and quality. Reverse gear is a "constant mesh" design which allows reverse gear to be located directly behind overdrive (OD) gear in the shift pattern. A reverse blocker is incorporated to prevent accidental shifts from overdrive to reverse.

SPEEDOMETER PINION GEAR

Removal and Installation

Rear axle gear ratio and tire size determines the pinion gear size requirements.

(1) Place drain pan under speedometer adapter.

(2) Remove bolt and retainer securing speedometer pinion adapter in the extension housing (Fig. 1).

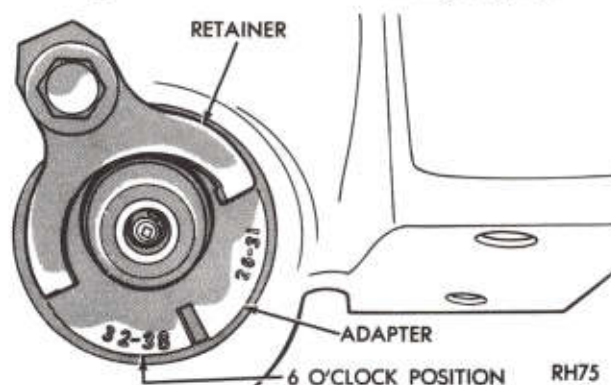


Fig. 1—Speedometer Installed

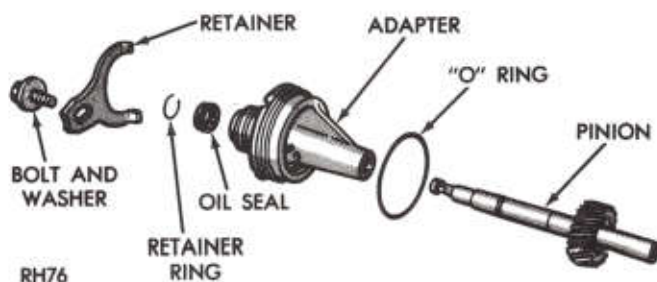


Fig. 2—Speedometer Pinion and Adapter

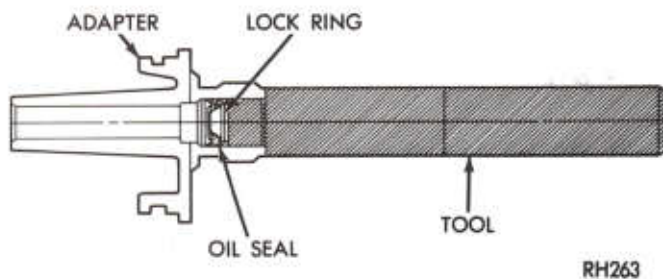


Fig. 3—Install Speedometer Pinion Seal

(3) If transmission fluid is found in cable housing, replace seal in the adapter (Fig. 1). Start seal and retainer ring in the adapter, then push them into adapter with Tool C-4004 until tool bottoms (Fig. 3).

(4) Note number of gear teeth and install pinion into adapter.

CAUTION: Before installing pinion and adapter assembly make sure adapter flange and its mating areas on extension housing are perfectly clean. Dirt or sand will cause misalignment resulting in speedometer pinion gear damage.

(5) Rotate the speedometer pinion gear and adapter assembly so that the number on the adapter, corresponding to the number of teeth on the gear, is in the 6 o'clock position as the assembly is installed (Fig. 1).

(6) Install retainer and bolt, with retainer tangs in adapter positioning slots. Tap adapter firmly into the extension housing and tighten retainer bolt to 100 in. lbs. (11 N·m).

(7) Connect speedometer cable to adapter.

(8) Fill transmission to lever of fill plug (refer to Lubrication Group "O").

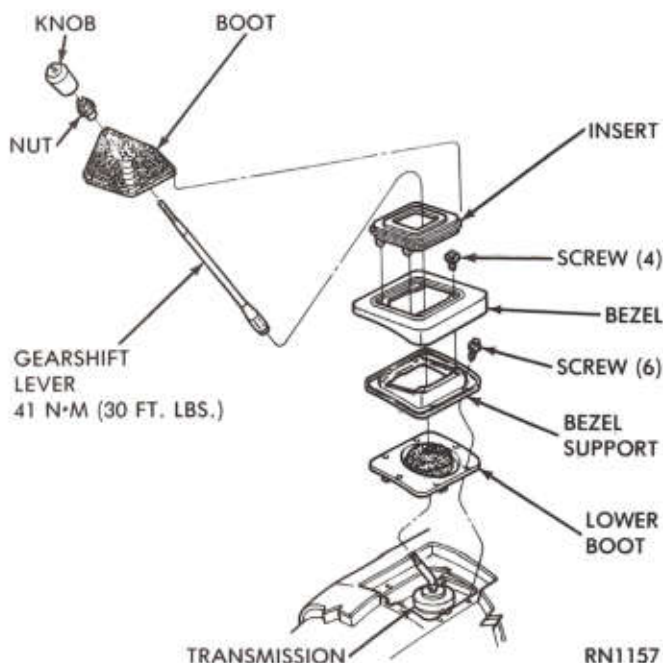


Fig. 1—Gearshift Lever and Boot Assembly

Gearshift Lever

(1) Remove gearshift lever from shifter assembly (Fig. 1).

(2) Remove transmission from vehicle (Fig. 2).

(3) Disassemble transmission in the following sequence as shown:

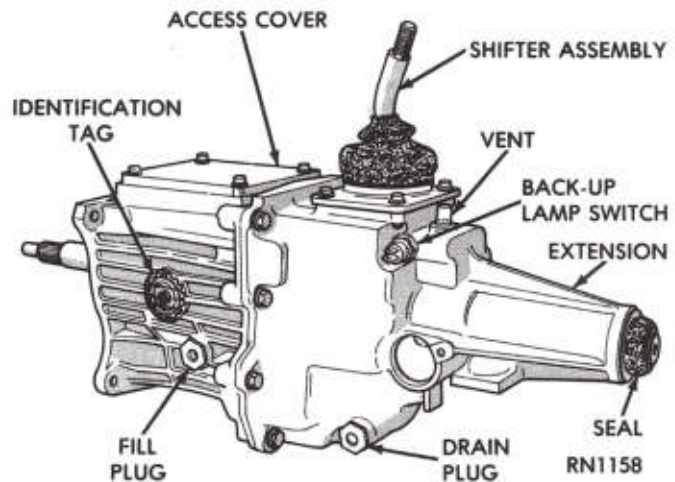


Fig. 2—Transmission Removed

Transmission Disassembly

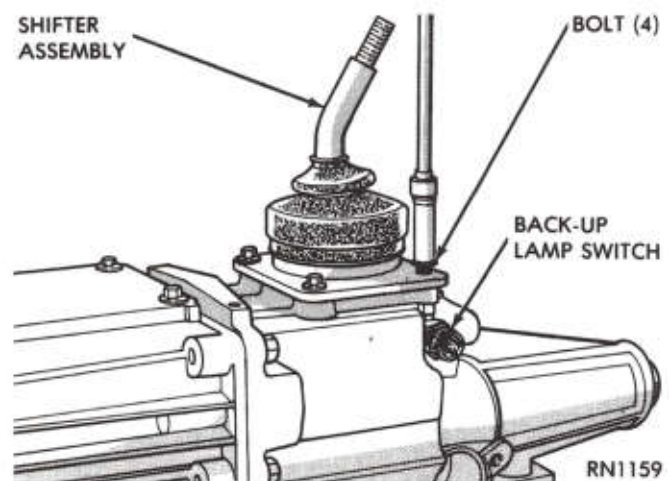


Fig. 1—Shifter Assembly Bolts

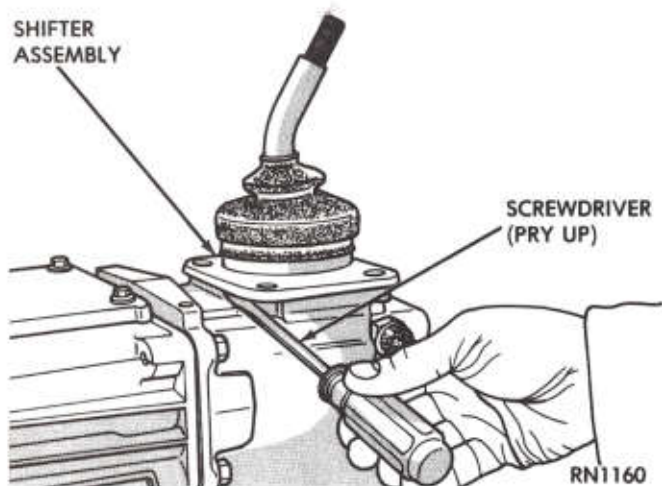


Fig. 2—Pry Shifter Assembly

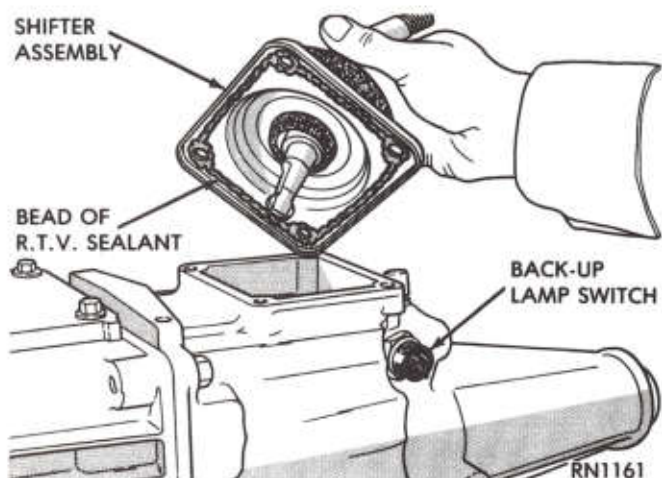


Fig. 3—Shifter Assembly

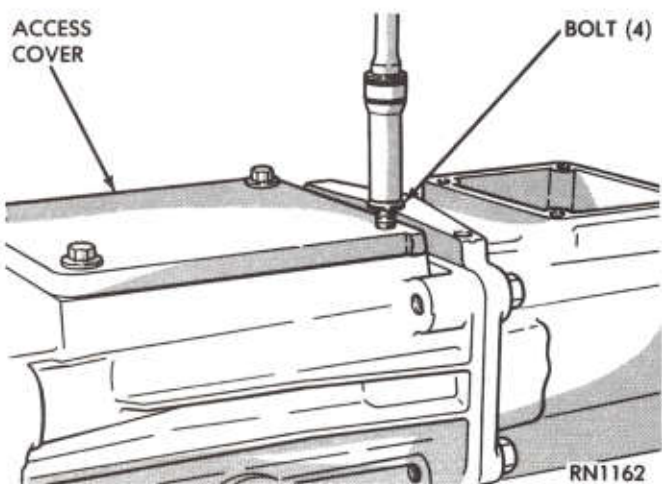


Fig. 4—Access Cover Bolts

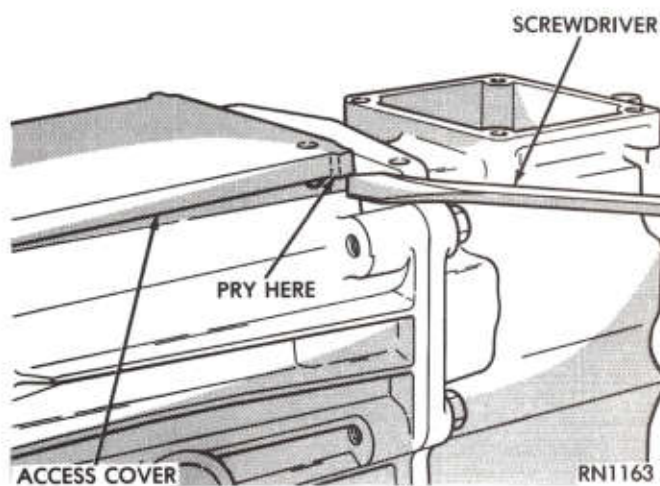


Fig. 5—Pry Access Cover

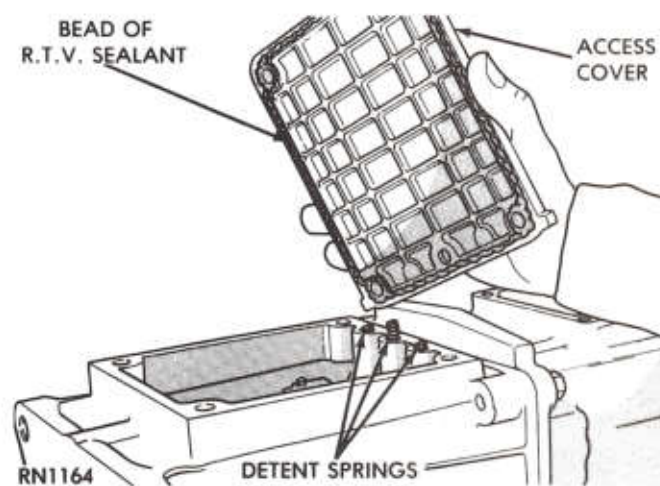


Fig. 6—Access Cover

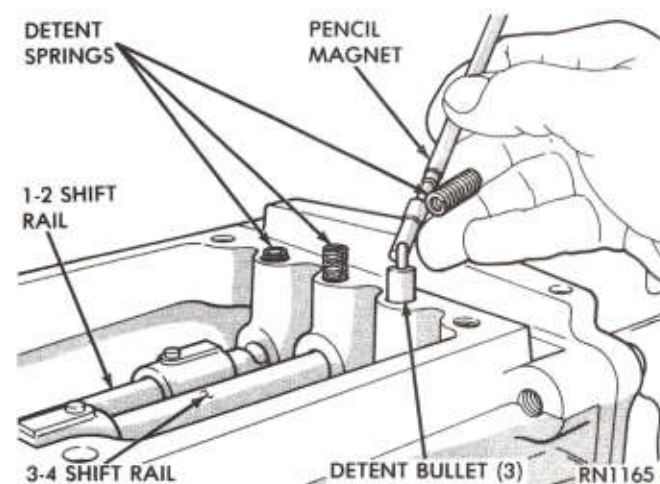


Fig. 7—Detent Springs and Bullets

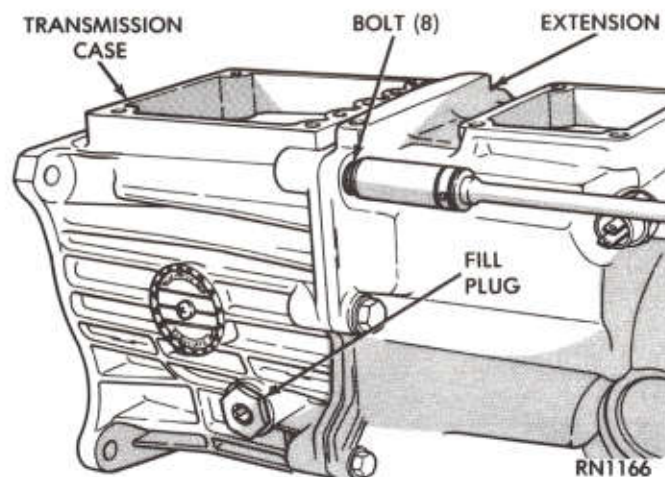


Fig. 8—Extension Bolts

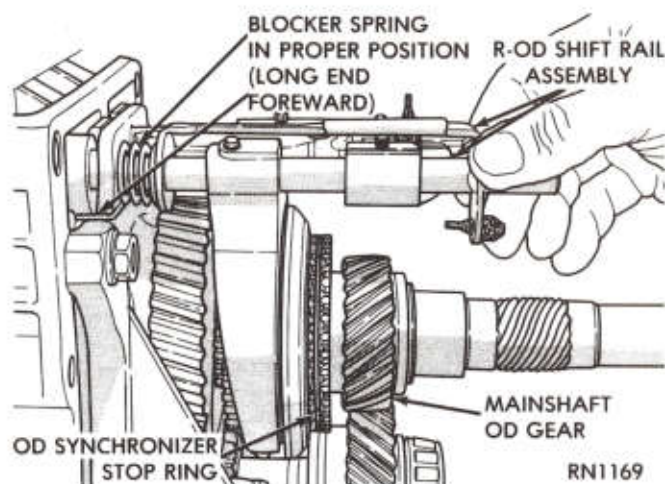


Fig. 11—Blocker Spring in Position

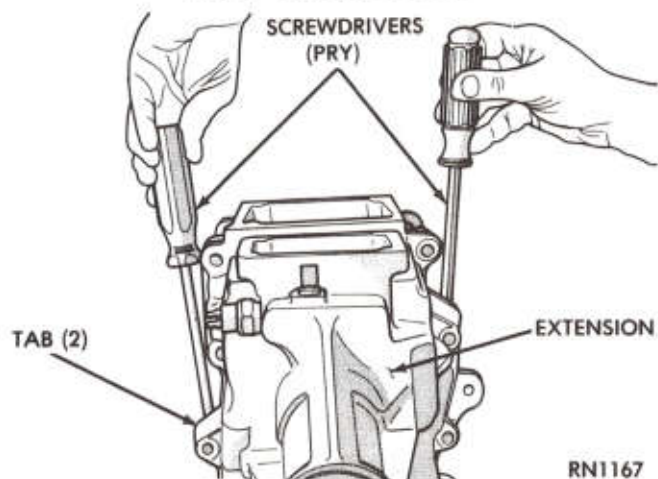


Fig. 9—Pry Extension

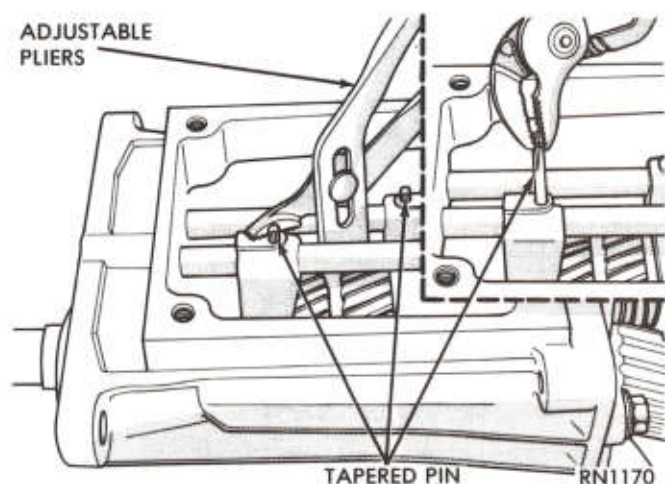


Fig. 12—Shift Forks Tapered Pins

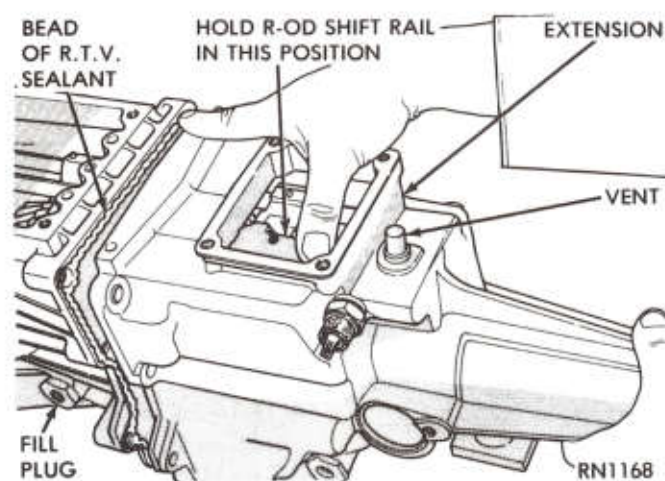


Fig. 10—Remove or Install Extension

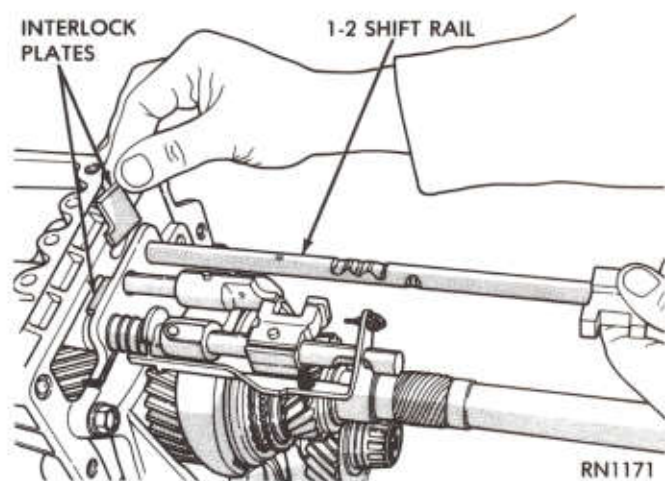


Fig. 13—1-2 Shift Rail

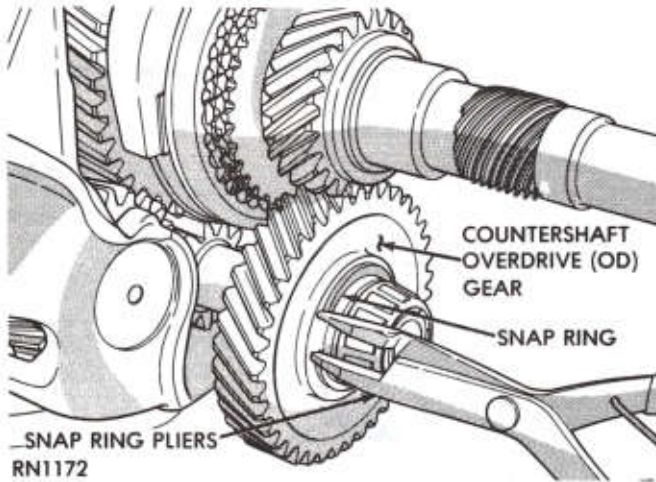


Fig. 14—Countershaft OD Gear Snap Ring

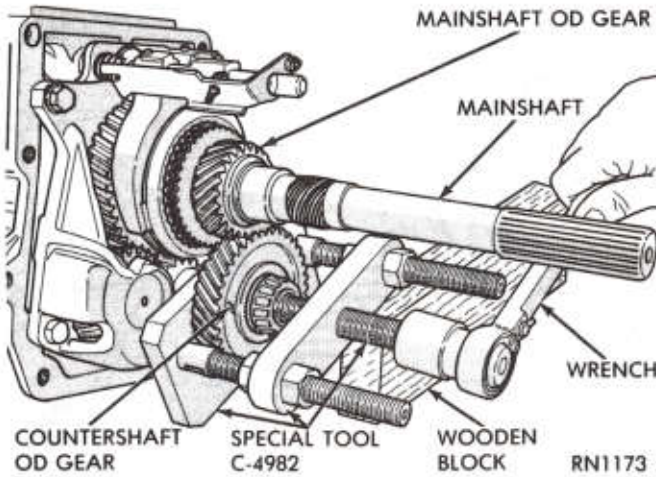


Fig. 15—Remove Countershaft OD Gear

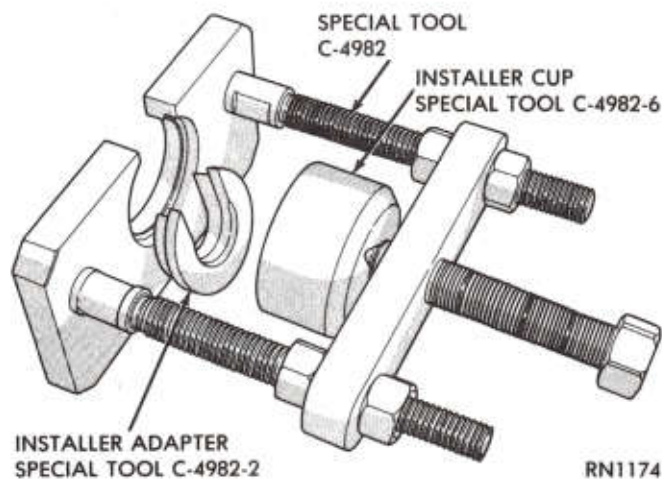


Fig. 16—Special Tool C-4982

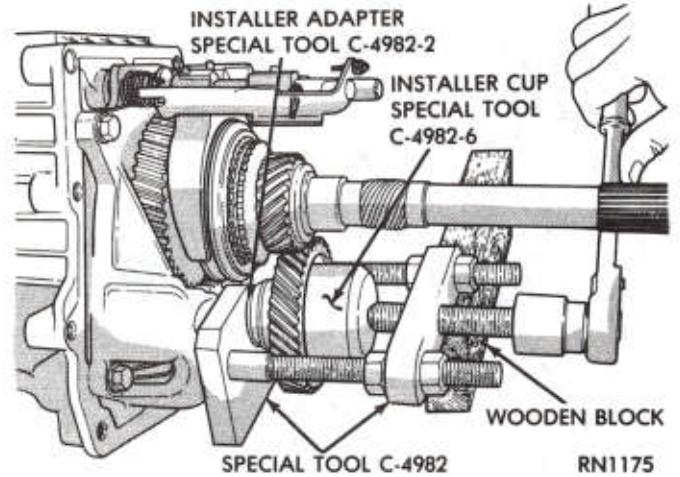


Fig. 17—Install Countershaft OD Gear

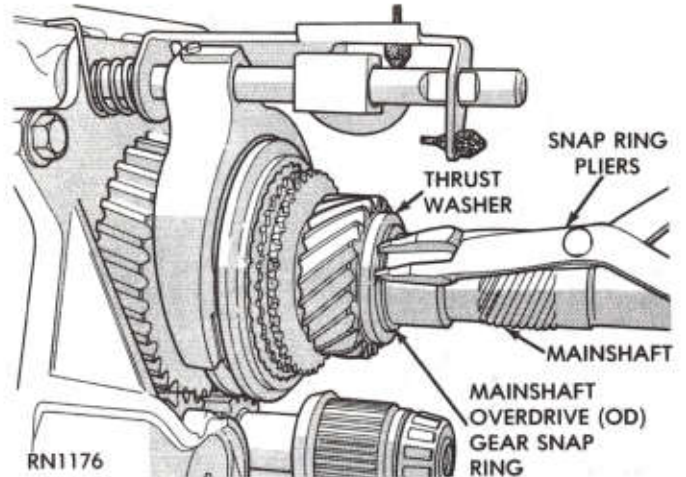


Fig. 18—Mainshaft OD Gear Snap Ring

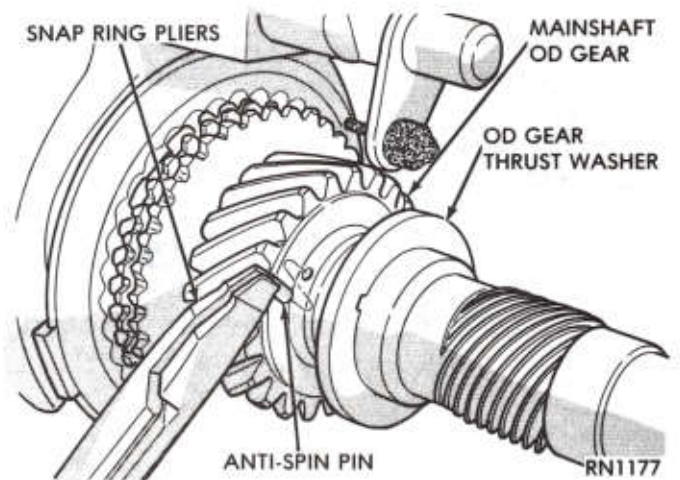


Fig. 19—Thrust Washer and Anti-Spin Pin

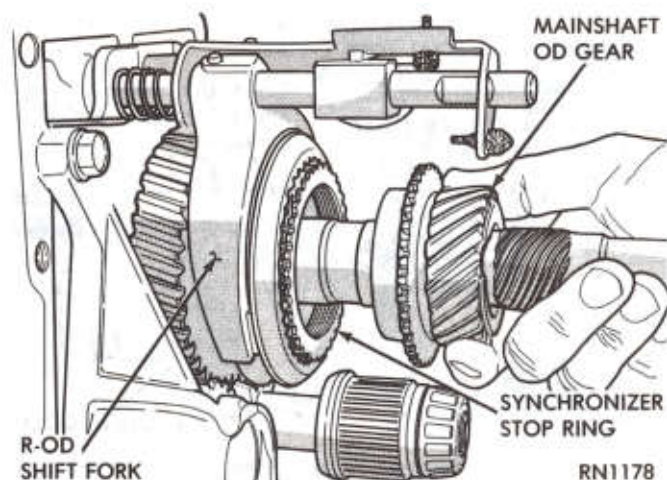


Fig. 20—Mainshaft OD Gear

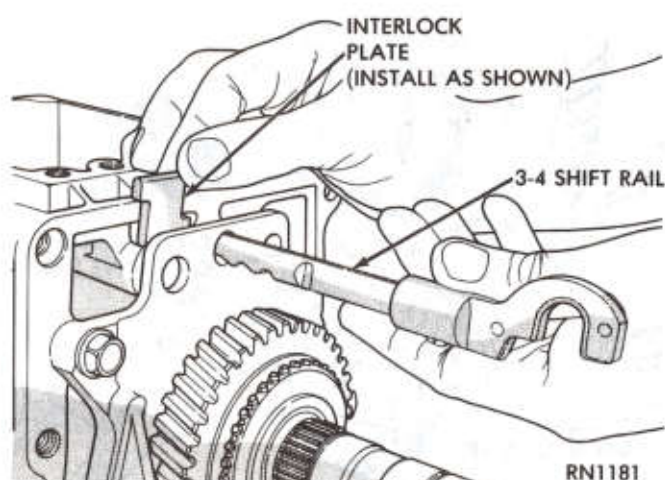


Fig. 23—3-4 Shift Rail

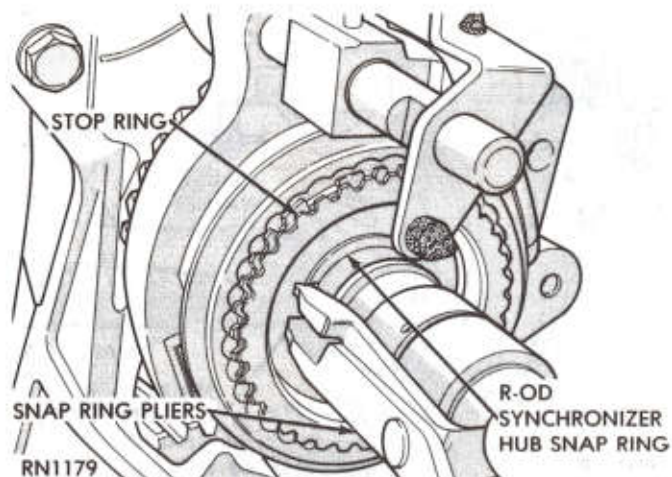


Fig. 21—R-OD Synchronizer Hub Snap Ring

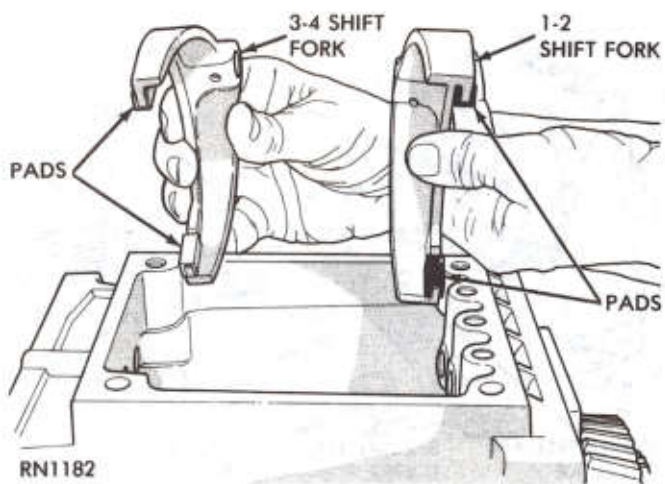


Fig. 24—1-2 and 3-4 Shift Forks

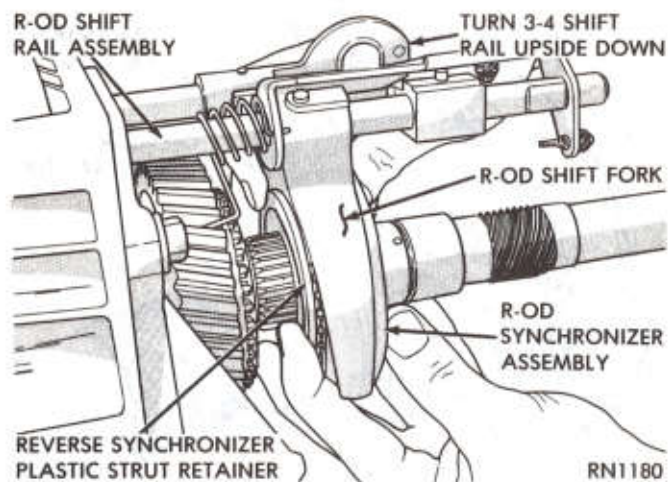


Fig. 22—R-OD Synchronizer, Fork, and Rail Assembly

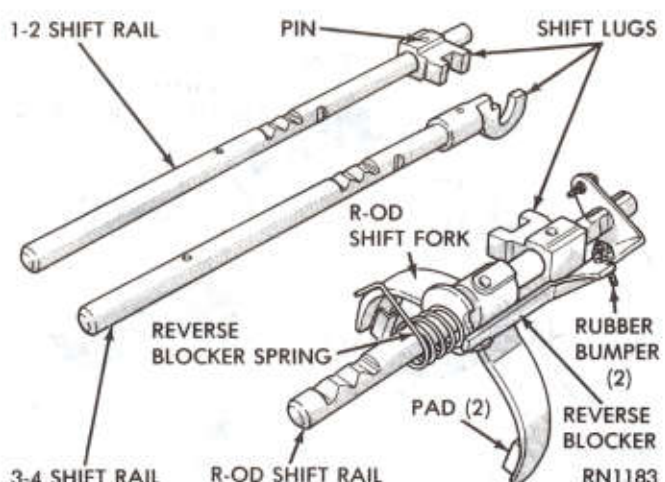


Fig. 25—Shift Rails

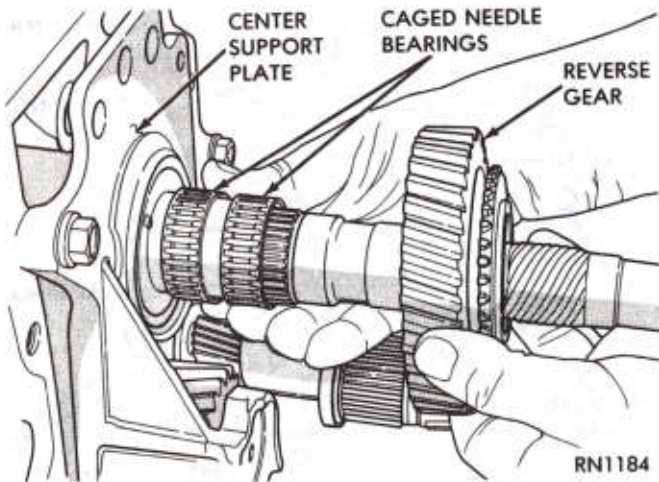


Fig. 26—Reverse Gear

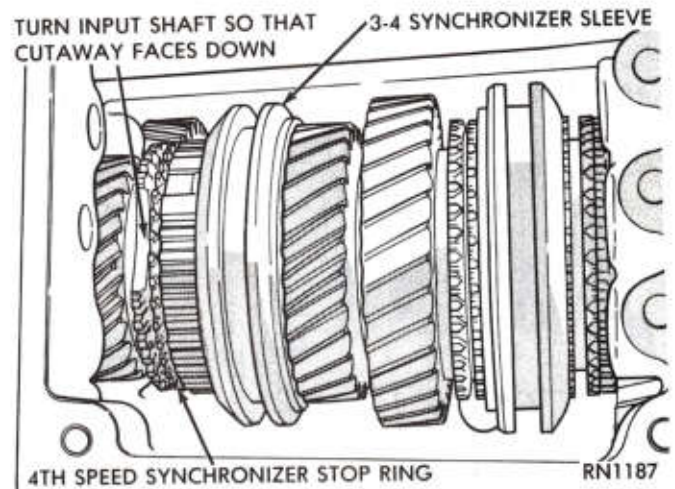


Fig. 29—Drive Pinion Gear Cutaway Area Faces Countershaft

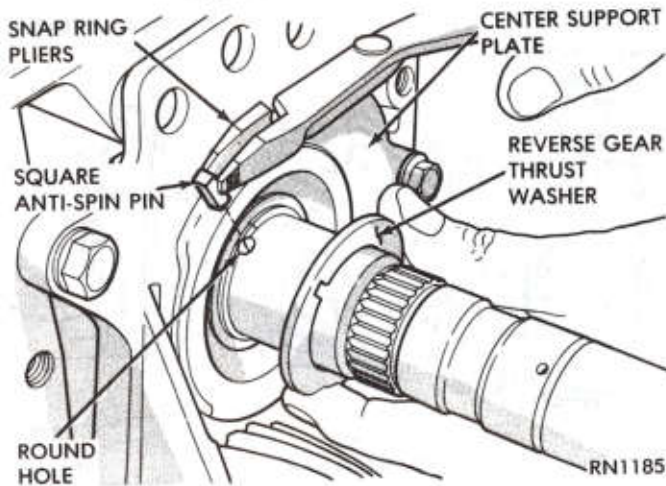


Fig. 27—Reverse Gear Thrust Washer

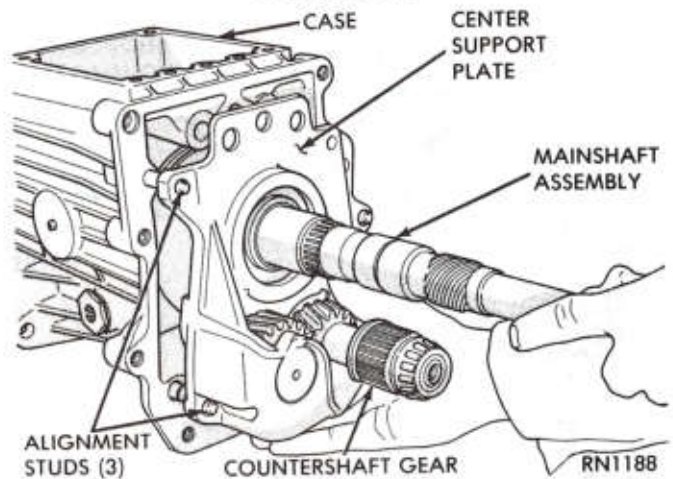


Fig. 30—Remove or Install Gear Set

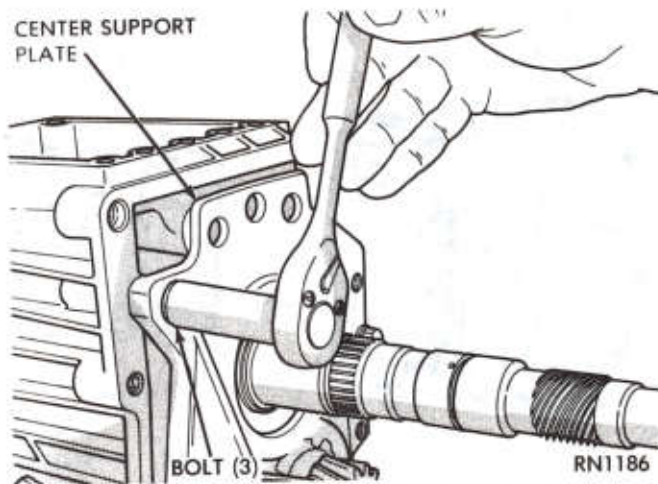


Fig. 28—Center Support Plate Bolts

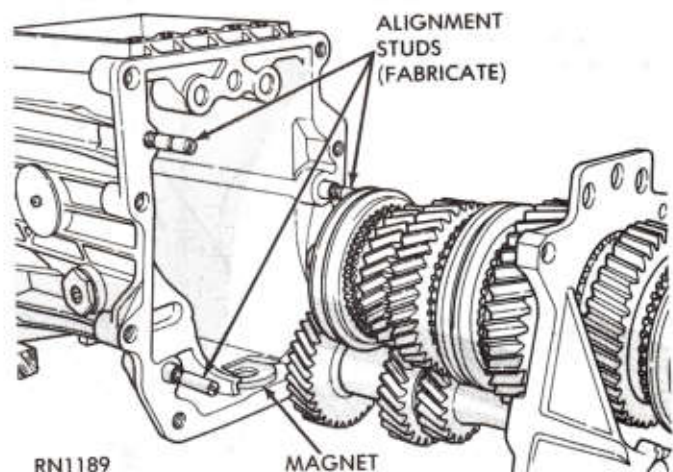


Fig. 31—Alignment Studs

To assemble, reverse the above procedure.

Gear Set — Recondition

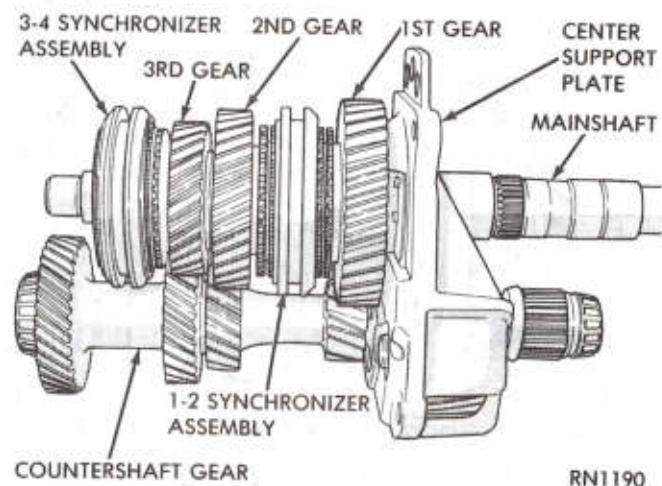


Fig. 1—Gear Identification

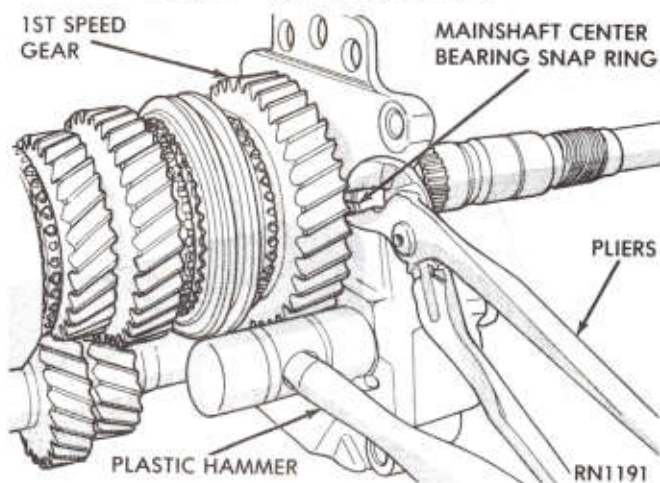


Fig. 2—Remove or Install Mainshaft Assembly

CAUTION: Chamfered side of snap ring must face 1st Speed Gear.

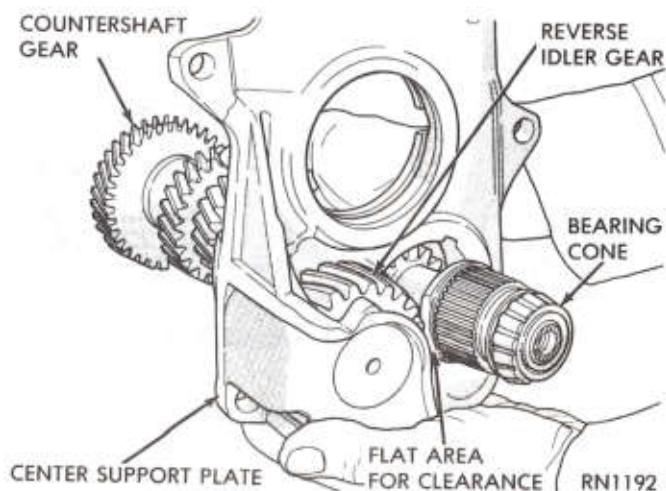


Fig. 3—Countershaft Gear

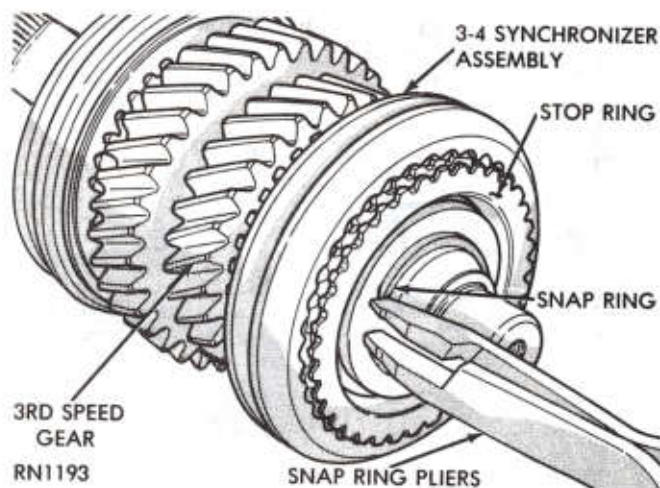


Fig. 4—3-4 Synchronizer Hub Snap Ring

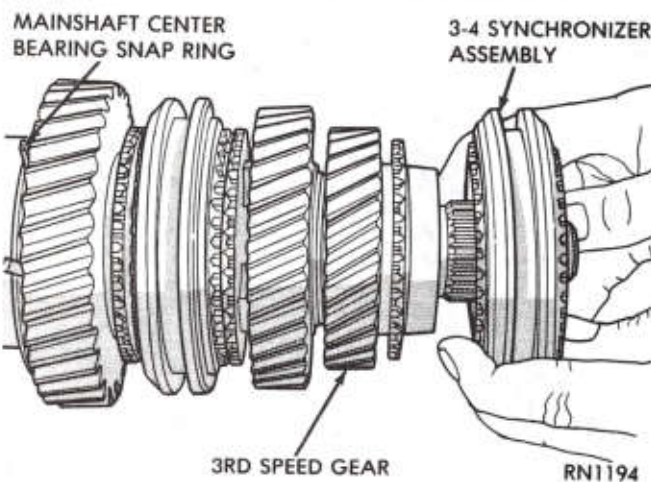


Fig. 5—3-4 Synchronizer Assembly

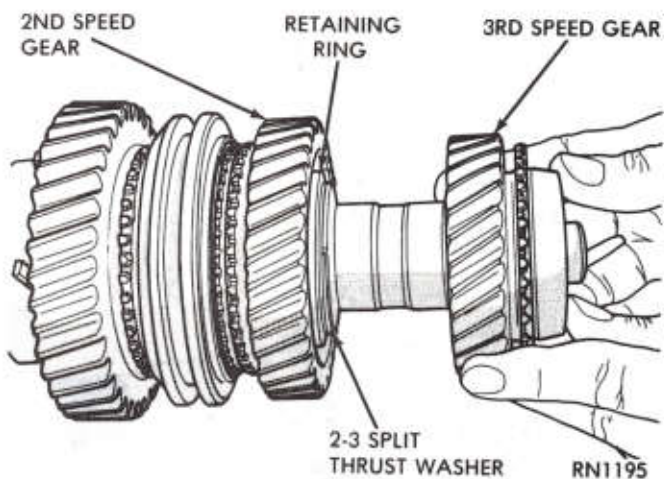


Fig. 6—3rd Speed Gear

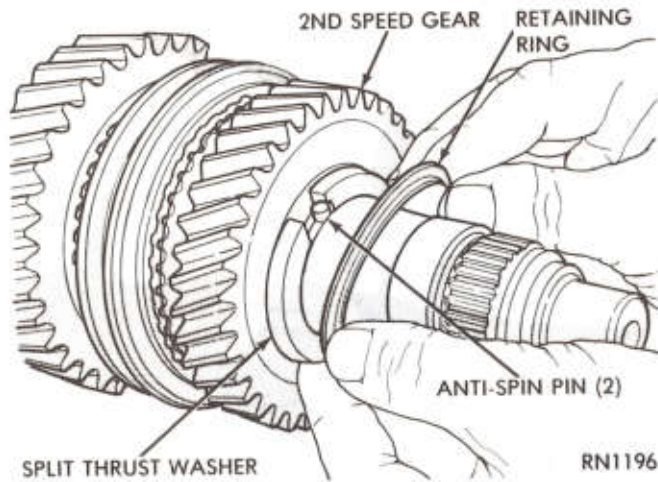


Fig. 7—Split Thrust Washer

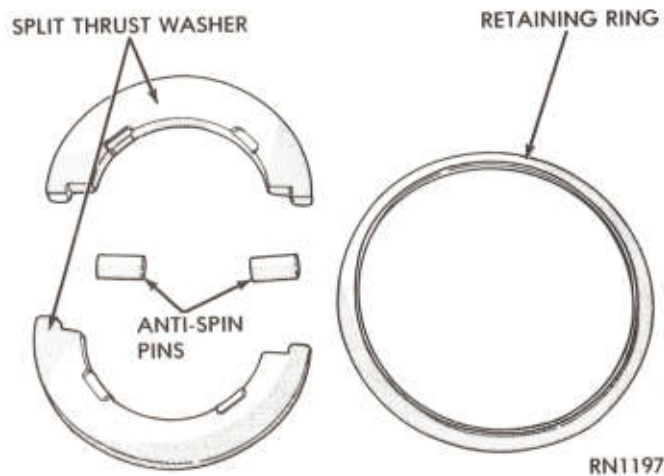


Fig. 8—Thrust Washer and Retaining Ring

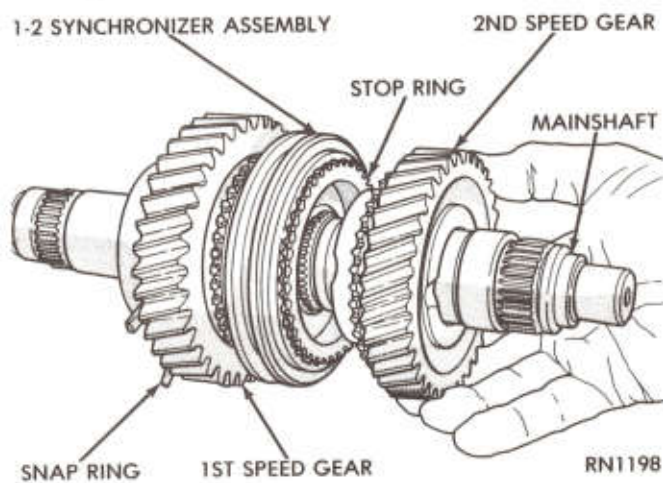


Fig. 9—2nd Speed Gear

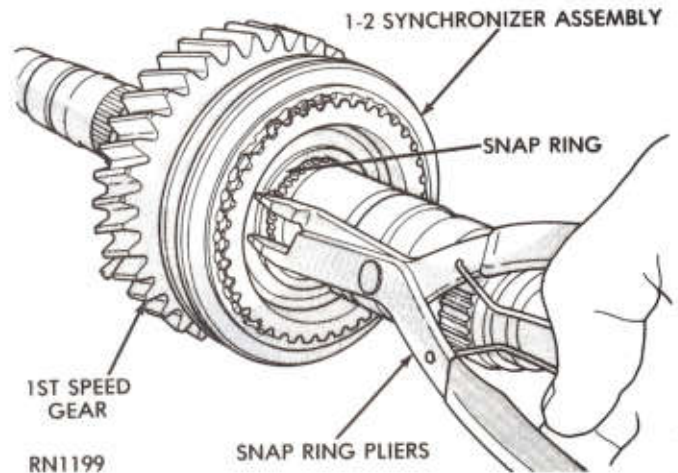


Fig. 10—1-2 Synchronizer Hub Snap Ring

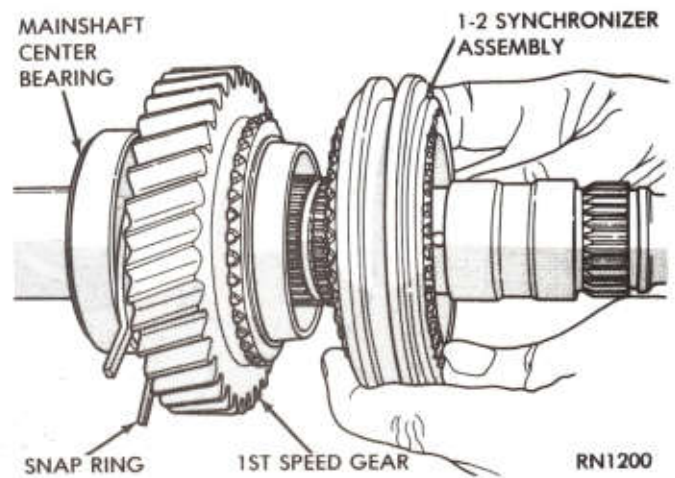


Fig. 11—1-2 Synchronizer Assembly

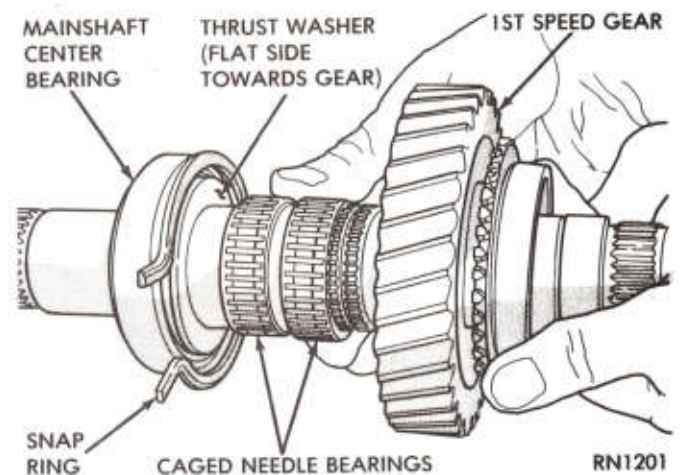


Fig. 12—1st Speed Gear

CAUTION: Chamfered side of snap ring must face 1st Speed gear.

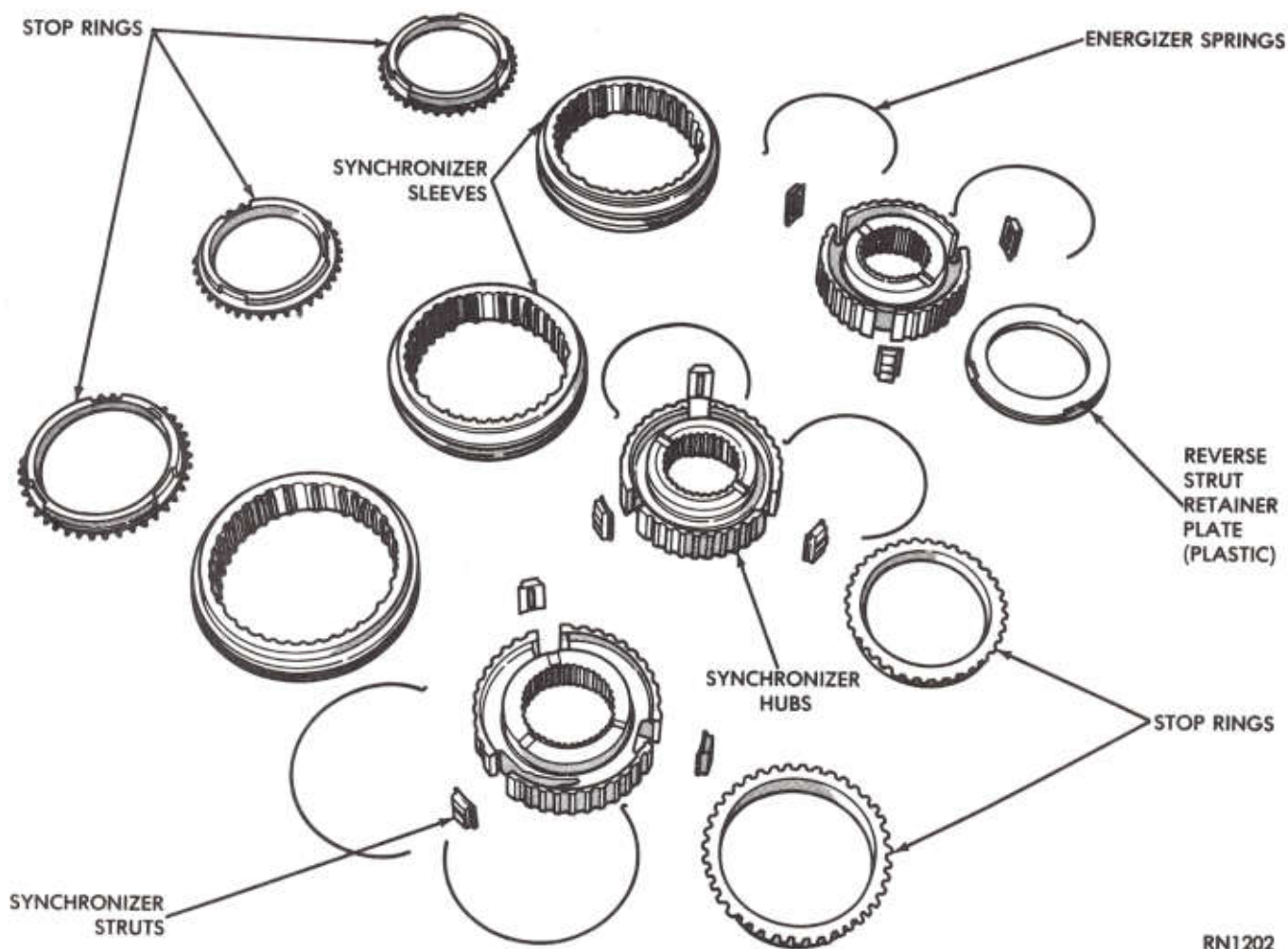


Fig. 13—Synchronizers Identification

To assemble, reverse the above procedure.

Mainshaft Center Bearing

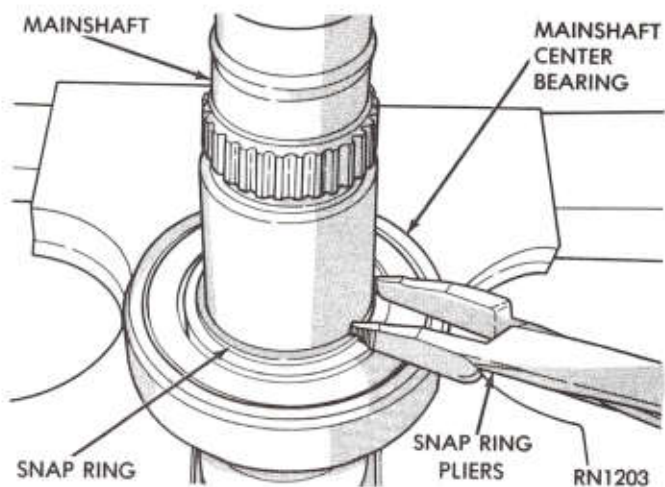


Fig. 1—Bearing Snap Ring

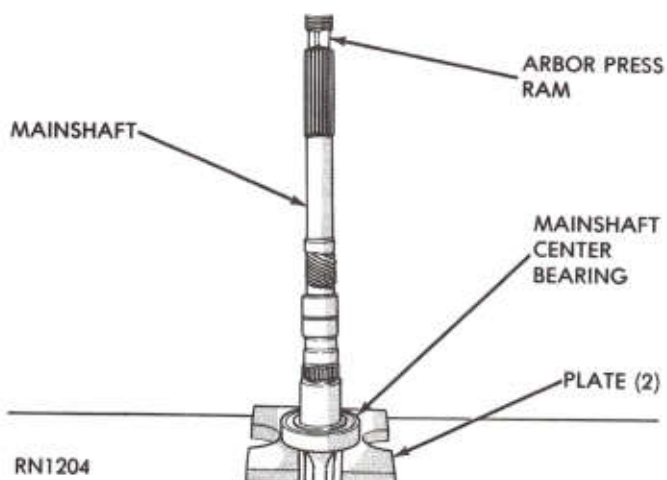


Fig. 2—Remove Bearing

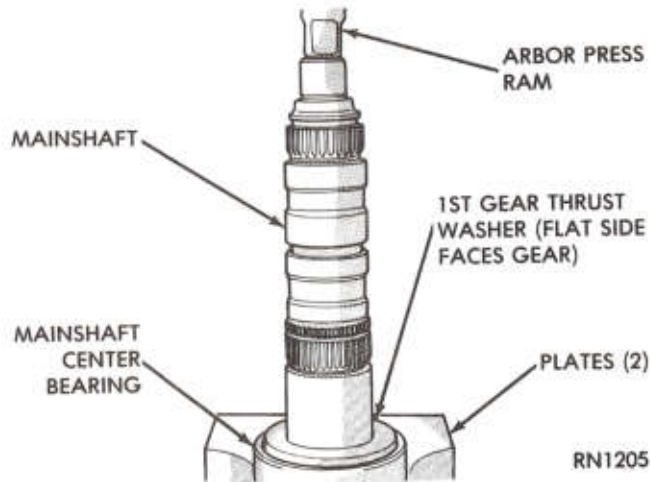


Fig. 3—Install Bearing

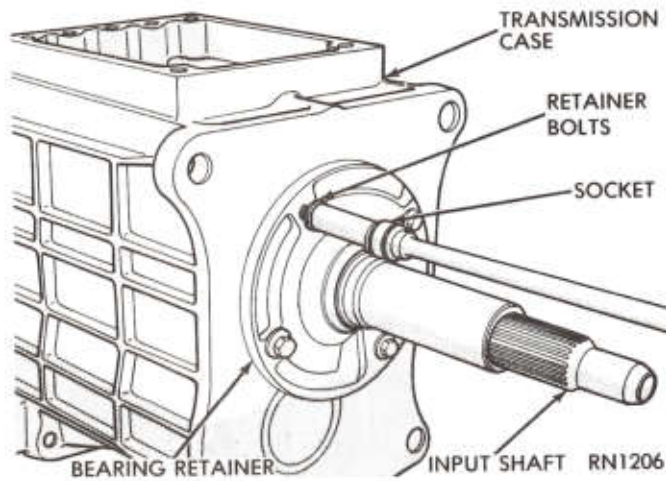
Input Shaft and Retainer

Fig. 1—Retainer Bolts

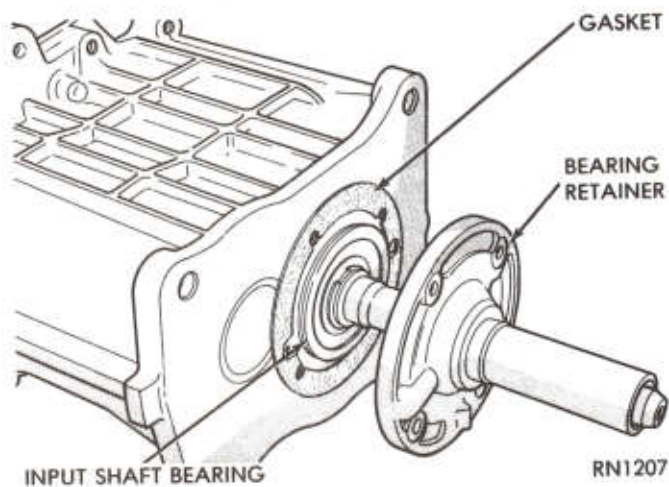


Fig. 2—Retainer and Gasket

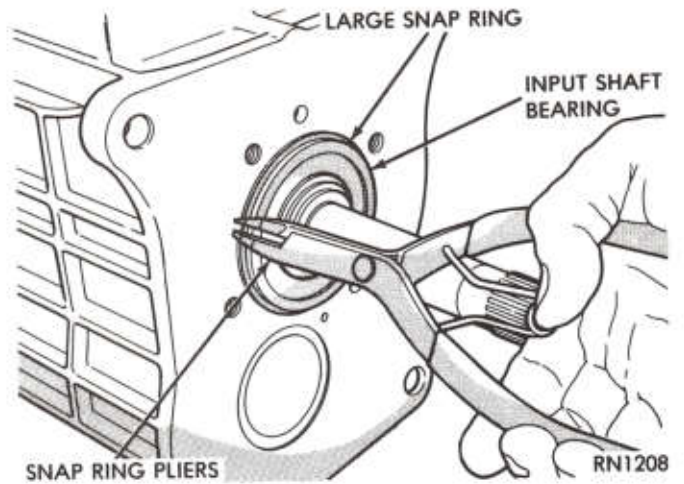


Fig. 3—Bearing Large Snap Ring

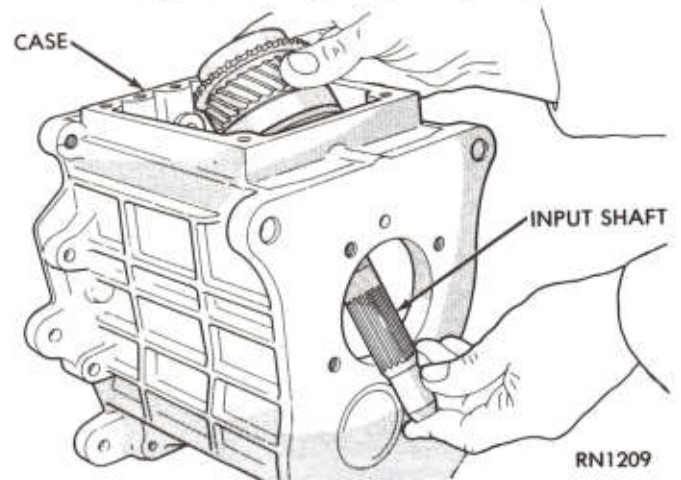


Fig. 4—Remove or Install Input Shaft

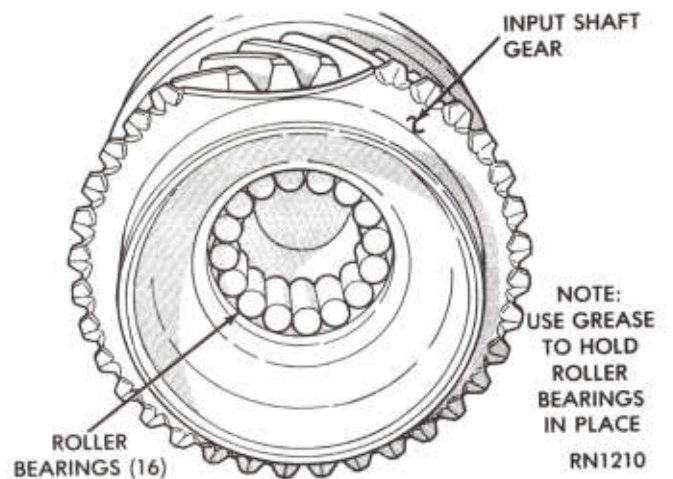


Fig. 5—Roller Bearings

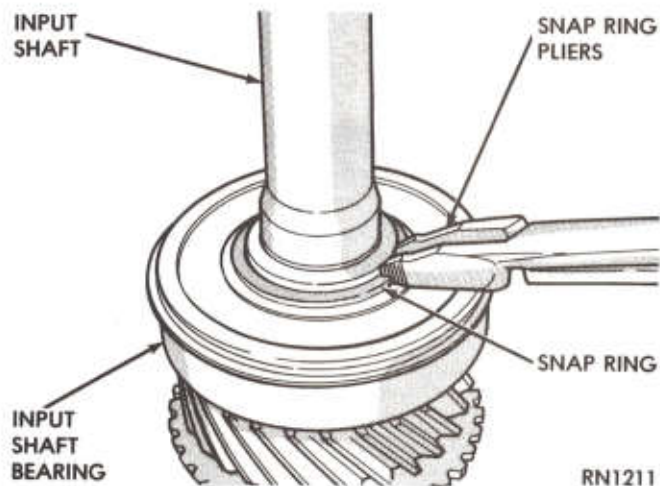


Fig. 6—Input Shaft Bearing Snap Ring

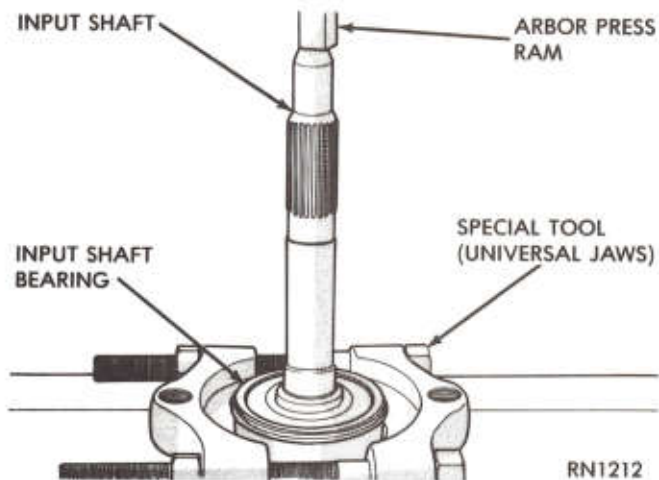


Fig. 7—Remove Input Shaft Bearing

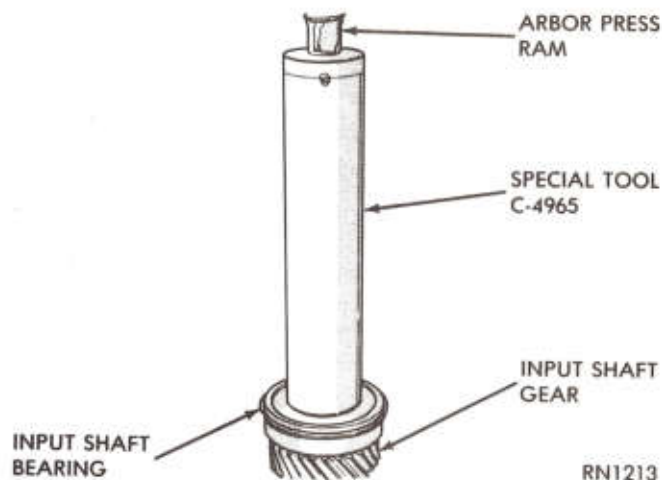


Fig. 8—Install Input Shaft Bearing

Using a suitable tool, remove input shaft retainer oil seal, if required.

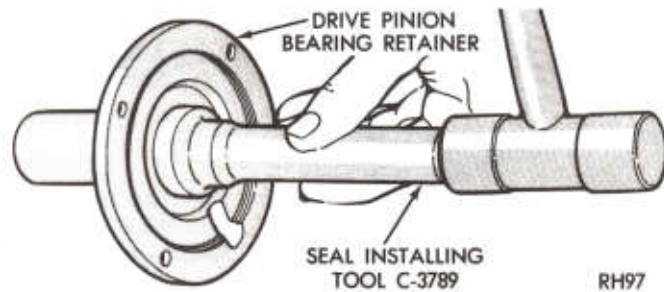


Fig. 9—Install New Oil Seal

Center Support Plate

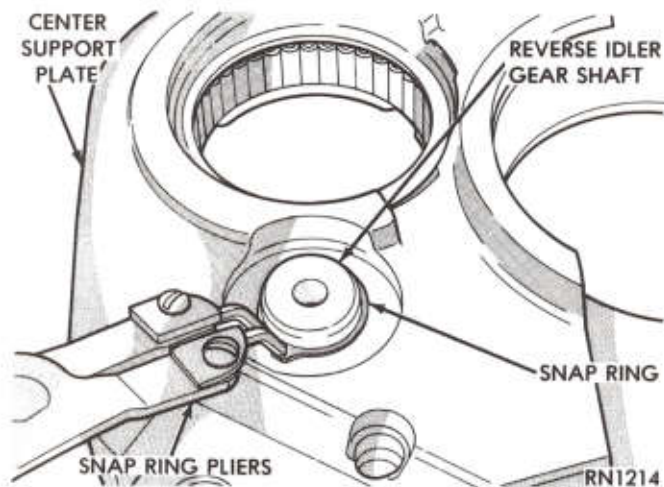


Fig. 1—Reverse Idler Shaft Snap Ring

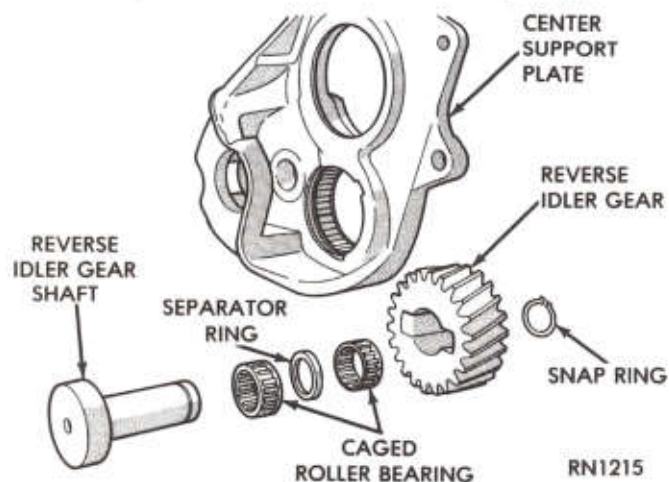


Fig. 2—Reverse Idler Gear

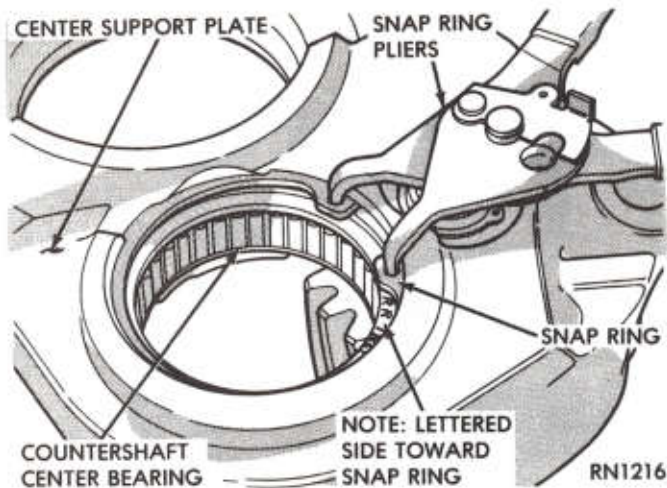


Fig. 3—Countershaft Center Bearing Snap Ring

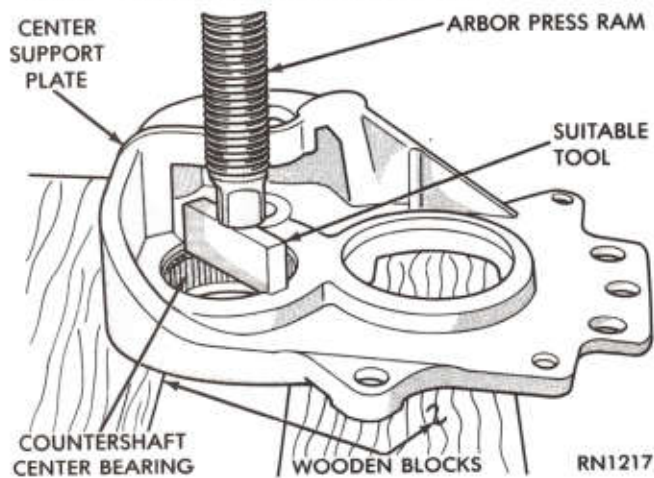


Fig. 4—Remove Countershaft Center Bearing

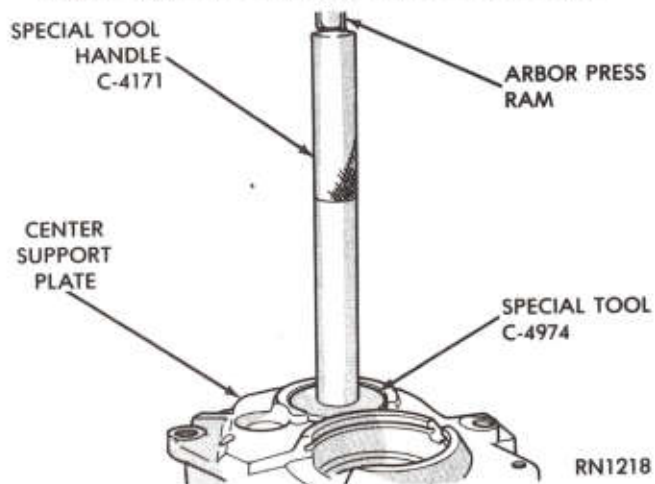


Fig. 5—Install Countershaft Center Bearing

Countershaft Gear Bearings

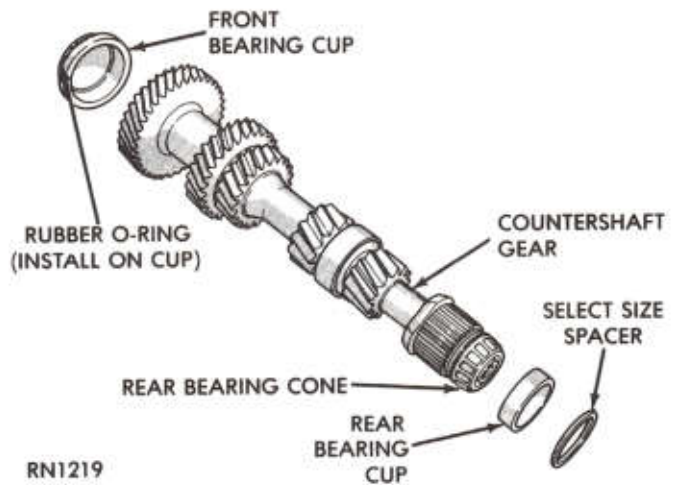


Fig. 1—Countershaft Gear

Select Shim Chart

Part No.	Thickness	
	Millimeters	Inches
4338275	1.37-1.39	.0539
4338276	1.46-1.48	.0579
4338277	1.55-1.57	.0614
4338278	1.64-1.66	.0650
4338279	1.73-1.75	.0685
4338280	1.82-1.84	.0720
4338281	1.91-1.93	.0756
4338282	2.00-2.02	.0791
4338283	2.09-2.11	.0827
4338284	2.18-2.20	.0862
4338285	2.27-2.29	.0898

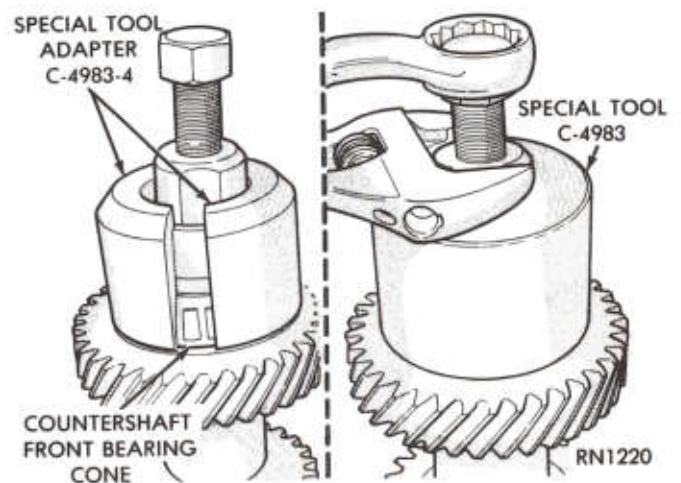


Fig. 2—Remove Front Bearing Cone

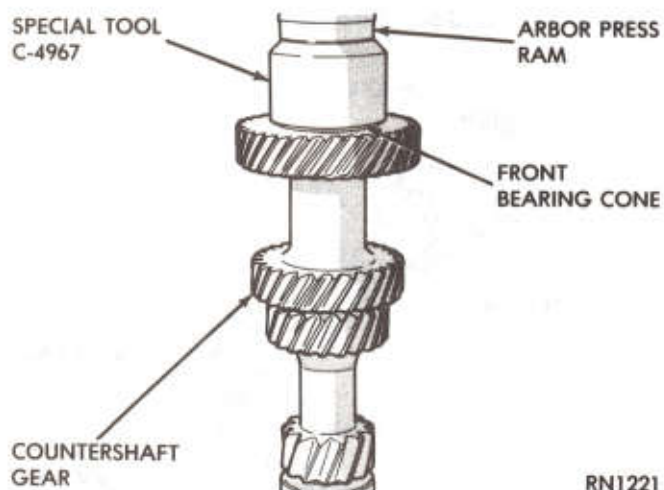


Fig. 3—Install Front Bearing Cone

RN1221

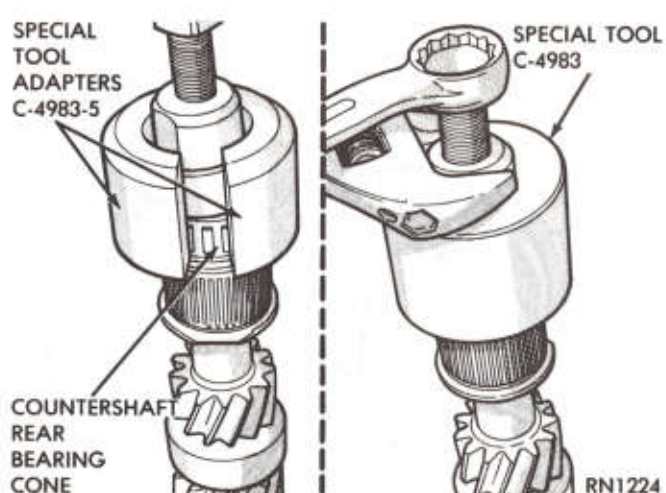


Fig. 6—Remove Rear Bearing Cone

RN1224

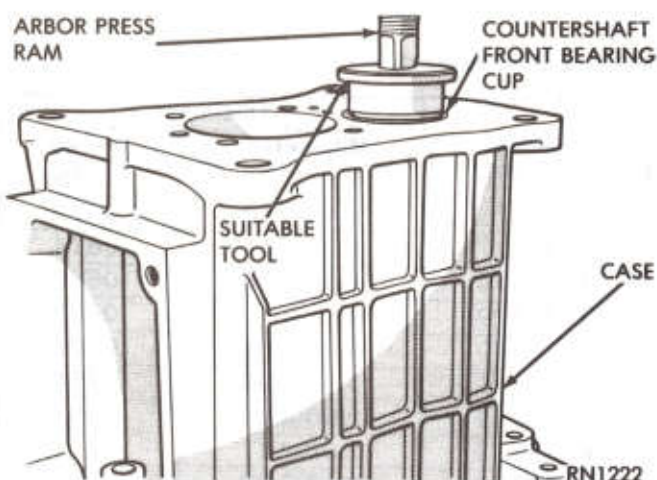


Fig. 4—Remove Front Bearing Cup

RN1222

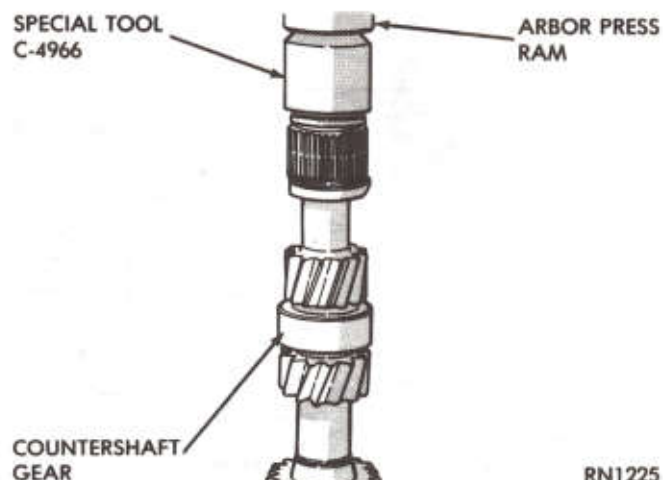


Fig. 7—Install Rear Bearing Cone

RN1225

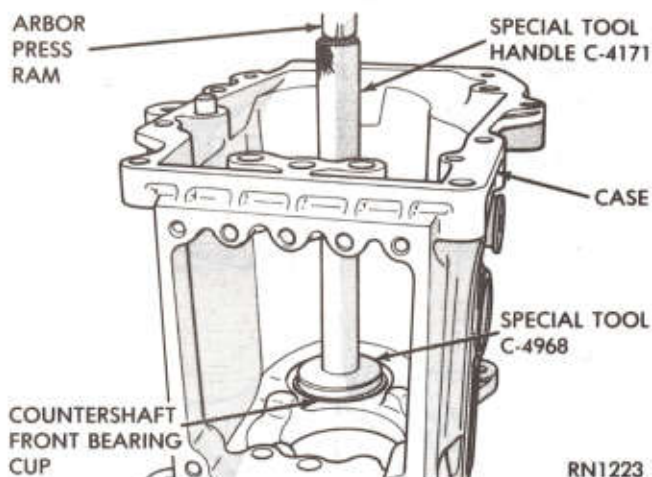


Fig. 5—Install Front Bearing Cup

RN1223

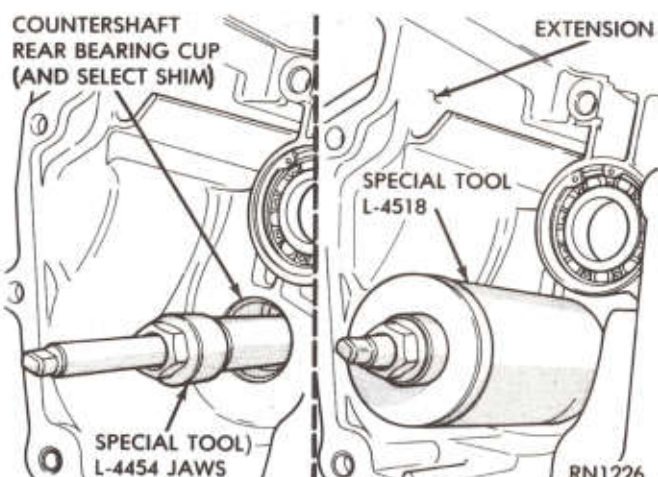


Fig. 8—Remove Rear Bearing Cup

RN1226

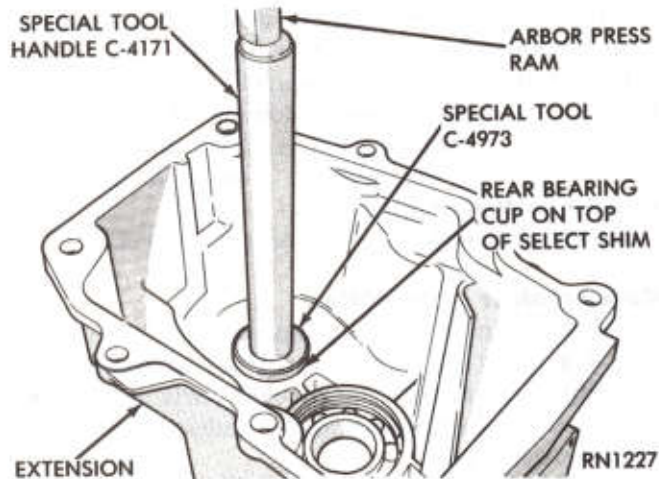


Fig. 9—Install Rear Bearing Cup

Extension

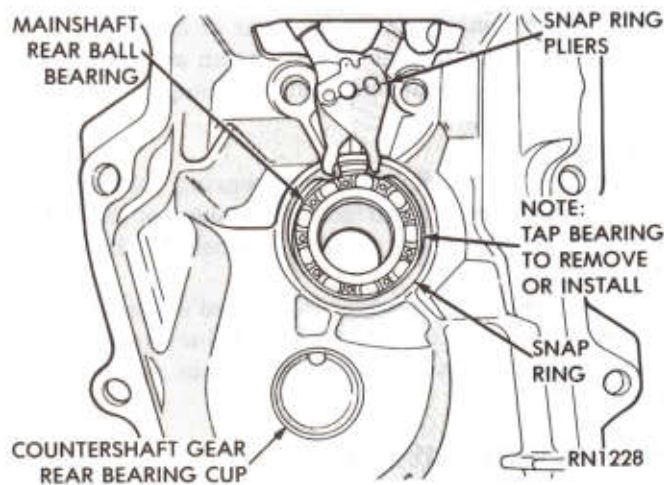


Fig. 1—Replace Extension Ball Bearing

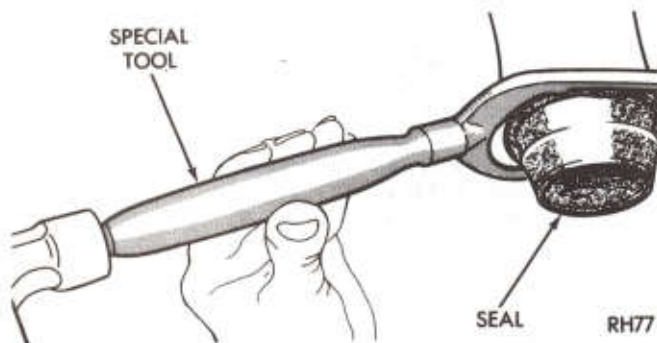


Fig. 2—Remove Extension Housing Yoke Seal

(1) Remove seal with Tool C-3985.

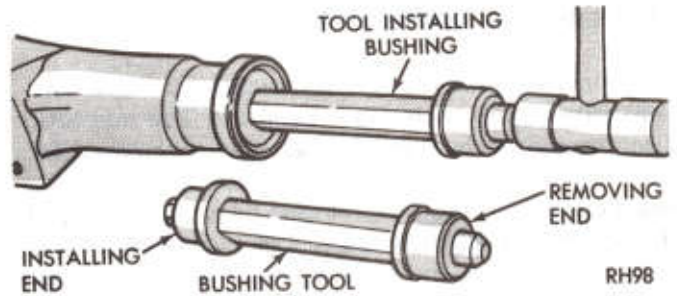


Fig. 3—Replacing Extension Housing Bushing

(2) Replace bushing with Tool C-3996.

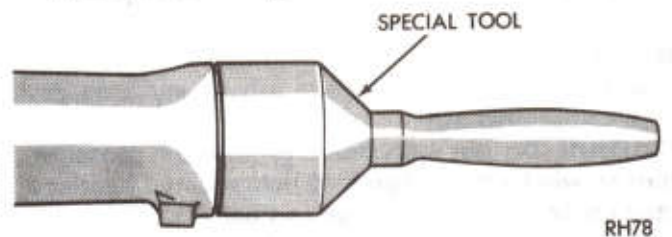


Fig. 4—Install Extension Housing Yoke Seal

(3) Install new seal with Tool C-3995.

To rebuild transmission, reverse the above procedure.

Countershaft Gear End Play

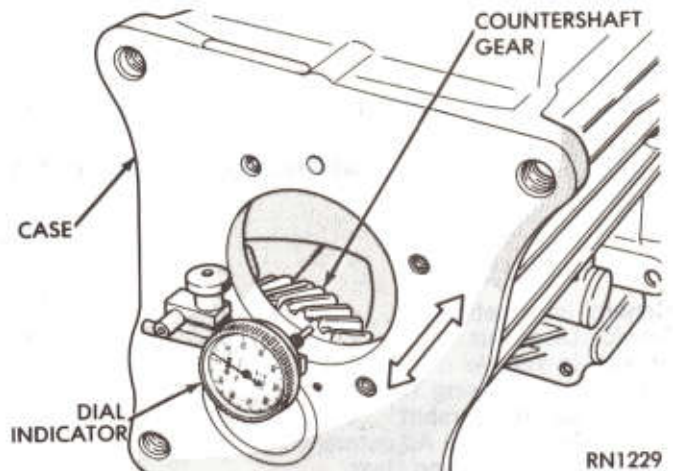


Fig. 1—Countershaft Gear End Play

See "Select Shim Chart" for proper shim, to obtain .03 to .13 millimeter (.001 to .005 inch) countershaft gear end play.

CLEANING AND INSPECTION

Clean transmission case thoroughly, using a suitable solvent, dry with compressed air. The magnetic disc, located on bottom of case, can be removed for cleaning. After cleaning the magnetic disc with a clean cloth, reinstall. Inspect case for cracks, stripped threads in various bolt holes, and machined mating surfaces for burrs, nicks, or any condition that would render the case unfit for further service. The front mating surface should be smooth; if any burrs are present, dress them off with a fine mill file. If threads are stripped, install Helicoil, or equivalent inserts.

Bearings

Wash bearings, using a clean solvent and blow dry with compressed air.

CAUTION: Do not spin bearings with air pressure; turn slowly by hand. Spinning unlubricated bearings may cause damage to races and balls.

Be sure bearings are clean, then lubricate them with engine oil. Inspect bearings for roughness. This can best be determined by slowly turning by hand.

Needle Type Bearing Rollers and Spacers

Inspect all bearing rollers for flat spots or brinelling. Inspect all bearing roller spacers for signs of wear or galling. Inspect roller contact surfaces of gear and shaft. Install new parts as required.

Gears

Inspect countershaft gear and all gear teeth for

chipped or broken teeth, or showing signs of excessive wear. Small nicks or burrs must be stoned off.

Inspect teeth on drive pinion. If excessively worn, broken, or chipped, a new pinion should be installed. If the oil seal contact area on drive pinion shaft is pitted, rusted, or scratched, a new pinion is recommended for best seal life.

Inspect shift forks for wear on pads and shafts.

Synchronizer Assemblies

Inspect spline teeth on synchronizer clutch gears and stop rings. If there is evidence of chipping or excessively worn teeth, install new parts at reassembly. Be sure synchronizer sleeve slides easily on the synchronizer hub.

Inspect stop rings for cracks and wear. If rings are cracked or show signs of extreme wear on threaded bore, install new stop rings at reassembly. Test new rings for good fit on gear cones with minimum wobble. Check synchronizer struts for wear or breakage.

Synchronizers will be serviced as an assembly. Synchronizer parts should not be interchanged.

Mainshaft

Inspect mainshaft gear and bearing mating surfaces. If gear contact surfaces show signs of galling or are excessively worn, a new mainshaft should be installed.

Inspect snap ring grooves for burred edges. If rough or burred, remove condition using a fine file or crocus cloth. Inspect synchronizer hub splines on shaft for burrs.

MANUAL TRANSMISSION — "OVERDRIVE-4"

INDEX

	Page		Page
General Information	16	Service Out of Vehicle	19
Service Diagnosis	17	Assembling Transmission	25
Service In Vehicle	18	Cleaning and Inspection	25
Extension Housing Yoke Seal	19	Disassembling Transmission	21
Four Speed Gearshift	18	Extension Housing Bushing Replacement	26
Gearshift Linkage Adjustment	18	Transmission Installation	28
Speedometer Pinion Gear	18	Transmission Removal	19

GENERAL INFORMATION

Safety goggles should be worn at all times when working on transmissions.

The overdrive-4 transmission (Figs. 1 and 2) is available as standard equipment for some models.

Synchronizers are serviced as an assembly. Except for stop rings, synchronizer parts should not be interchanged.

A pad is provided (Fig. 1) on right side of trans-

mission for transmission and vehicle identification numbers.

The drive pinion (input shaft) is supported by a ball bearing in the transmission case and an oilite bushing pressed in the end of the crankshaft.

The mainshaft front end is supported by roller bearings in the end of the main drive pinion and a ball bearing in the front of the extension housing. The

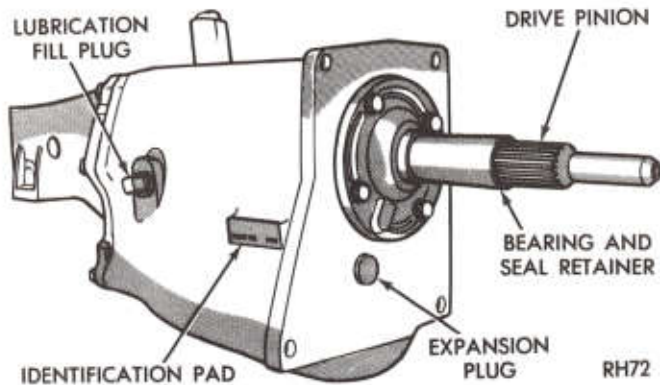


Fig. 1—Overdrive-4 Transmission

output end of the mainshaft is splined to the sliding universal joint yoke, which is supported by a bushing in the extension housing.

The countershaft gear is supported by a double row of needle type roller bearings at each end and the thrust is taken on thrust washers between the ends of the gear and the transmission case. The alignment of the needle type roller bearings within the gear is maintained by a tubular spacer in the center and four thrust washers (one being used between the rows of roller bearings and one at each end). The countershaft is **not** a press fit in the case bores, but has .005 inch diameter clearance. An expansion plug is pressed into a counter bore at the front of the case to prevent oil leakage around the countershaft.

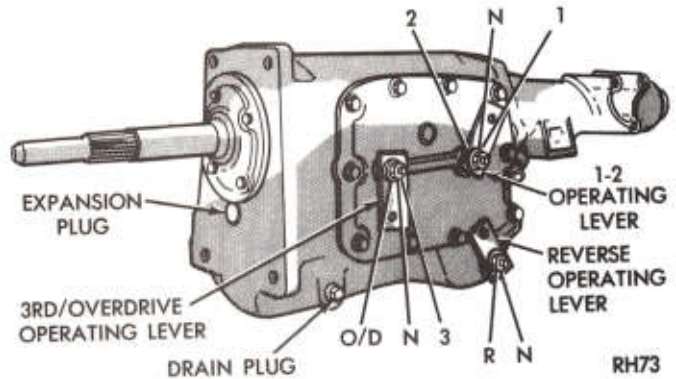


Fig. 2—Overdrive-4 Transmission

The reverse idler gear is supported on a bronze bushing, pressed into the gear.

A magnetic disc is attached to bottom, near rear of case under countershaft gear. This magnet collects and prevents circulation of chips in transmission oil.

The gearshifting is manually operated through shift control rods to the transmission. Any forward gear may be engaged while the vehicle is in motion through the use of synchronizing clutches. See "Specifications" for downshift speed limits.

The transmission may be used as an aid to deceleration by downshifting in sequence without double-clutching or gear clashing, due to the fact that all forward speeds are synchronized.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
HARD SHIFTING	(a) Synchronizer clutch sleeve damaged. (b) Synchronizer spring improperly installed. (c) Broken or worn synchronizer stop rings.	(a,b,c) Causes noted can only be corrected by disassembling transmission and replacing damaged or worn parts.
TRANSMISSION SLIPS OUT OF GEAR	(a) Linkage interference. (b) Gearshift rods out of adjustment. (c) Synchronizer clutch teeth worn. (d) Clutch housing bore or face out of alignment.	(a) Inspect and remove all linkage interferences. (b) Adjust gearshift rods as outlined in "Gearshift Linkage Adjustments." (c) Disassemble transmission and replace parts as necessary. (d) Refer to "Group 6" for correction procedures.
TRANSMISSION NOISES	(a) Excessive end play in countershaft gear. (b) Damaged, broken or excessively worn gear teeth. (c) Rough or pitted bearing races or balls.	(a) Replace thrust washers. (b) Replace worn gears. (c) Replace worn bearing.

SERVICE PROCEDURES

SERVICE IN VEHICLE

OVERDRIVE-4 SHIFT LINKAGE

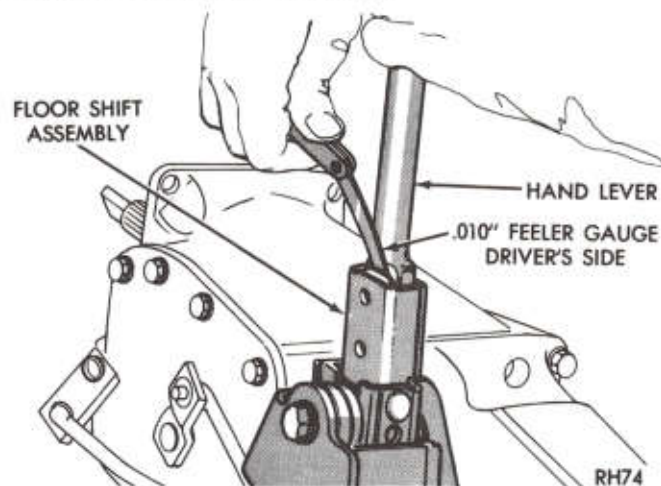


Fig. 3—Remove Hand Lever

Removal (Figs. 3 and 4)

- (1) Disconnect negative (ground) cable from the battery.
- (2) Remove retaining screws from floor pan boot and slide up and off hand lever.
- (3) Remove hand lever (Fig. 3).
- (4) Remove retaining clips, washers, and control rods from shift unit levers.
- (5) Remove 2 bolts and washers which secure shift unit to mounting plate on extension housing and remove unit.

Installation

Fasten unit to extension housing mounting plate with 2 bolts and lock washers and tighten both bolts to 30 ft. lbs. (41 N.m).

- (2) Install shift rods, washers, and clips.
- (3) Install hand lever.

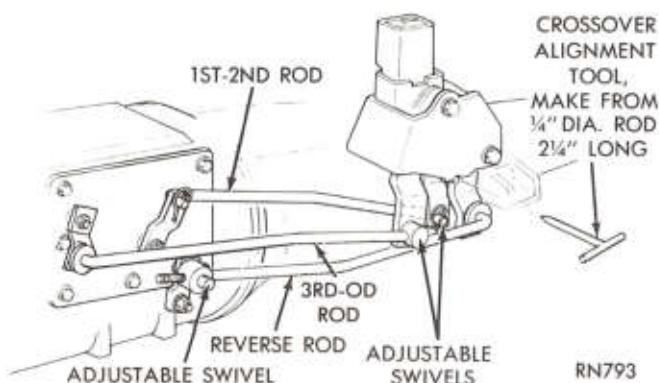


Fig. 4—Gearshift Linkage Adjustment

(4) Slide boot down over lever and fasten to floor pan.

- (5) Reconnect battery cable.

GEARSHIFT LINKAGE ADJUSTMENT

(1) Install aligning tool (Fig. 4) to hold the levers in the neutral-crossover position.

(2) With all rods removed from transmission shift levers, place levers in neutral detent position.

(3) Rotate threaded shift rods to make the length exactly right to enter transmission levers. Start with 1-2 shift rod (it may be necessary to pull clip at shifter end to rotate this rod).

(4) Replace washers and clips.

(5) Remove aligning tool and test shifting action.

SPEEDOMETER PINION GEAR

Removal and Installation

Rear axle gear ratio and tire size determines the pinion gear size requirements.

(1) Place drain pan under speedometer adapter.

(2) Remove bolt and retainer securing speedometer pinion adapter in the extension housing (Fig. 5).

(3) With cable housing connected, carefully work adapter and pinion out of the extension housing.

(4) If transmission fluid is found in cable housing, replace seal in the adapter (Fig. 6). Start seal and

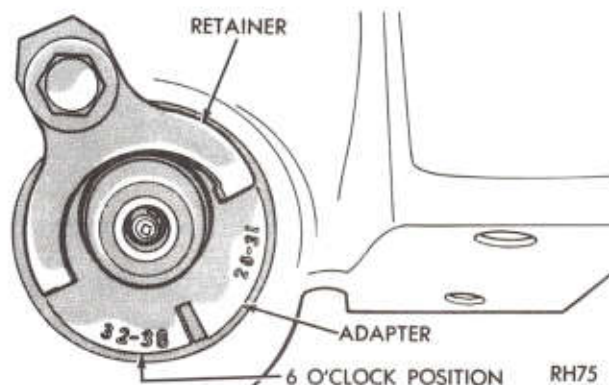


Fig. 5—Speedometer Pinion and Adapter

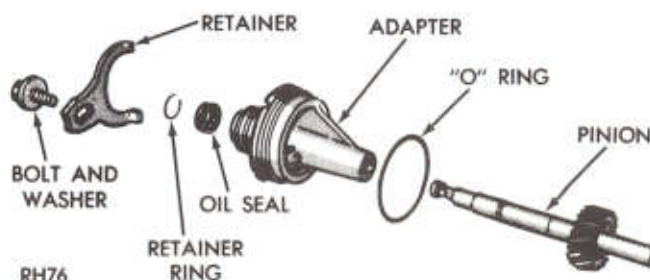


Fig. 6—Speedometer Pinion and Adapter

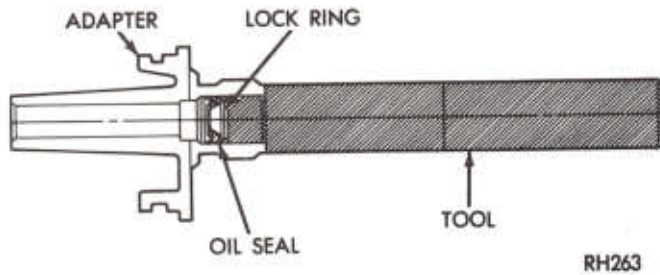


Fig. 7—Install Speedometer Pinion Seal

retainer ring in the adapter, then push them into adapter with Tool C-4004 until tool bottoms (Fig. 7).

(5) Note number of gear teeth and install pinion into adapter.

CAUTION: Before installing pinion and adapter assembly make sure adapter flange and its mating areas on extension housing are perfectly clean. Dirt or sand will cause misalignment resulting in speedometer pinion gear damage.

(6) Rotate the speedometer pinion gear and adapter assembly so that the number on the adapter, corresponding to the number of teeth on the gear, is in the 6 o'clock position as the assembly is installed (Fig. 5).

(7) Install retainer and bolt, with retainer tangs in adapter positioning slots. Tap adapter firmly into the extension housing and tighten retainer bolt to 100 in lbs. (11 N·m).

(8) Connect speedometer cable to adapter.

(9) Fill transmission to level of fill plug (refer to Lubrication Group "O").

EXTENSION HOUSING YOKE SEAL

Replacement

(1) Place drain pan under yoke seal.

(2) Disconnect propeller shaft at rear universal joint. Mark both parts to reassemble in same position. Carefully pull shaft yoke out of transmission extension housing.

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

(3) Remove oil seal with Tool C-3985-8 (Fig. 8).

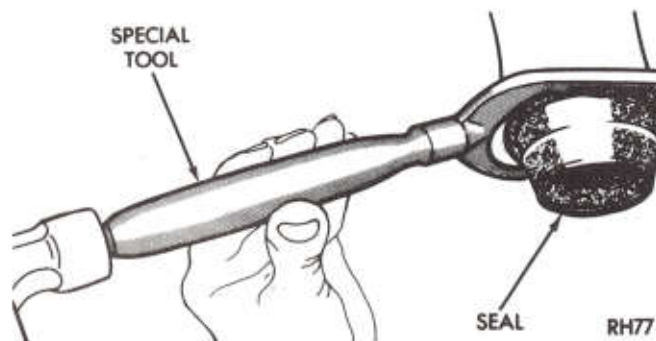


Fig. 8—Remove Extension Seal

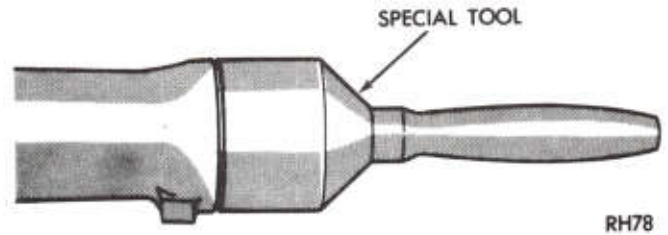


Fig. 9—Install Extension Seal

(4) To install a new seal, position seal in opening of extension housing and drive it into housing with Tool-C-3972 (Fig. 9).

(5) Carefully guide front universal joint yoke into extension housing and on the mainshaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion shaft yoke.

(6) Fill transmission to level of fill plug. (Refer to Lubrication Group "O").

SERVICE OUT OF VEHICLE

TRANSMISSION REMOVAL

(1) Remove gearshift components, refer to "overdrive-4 shift linkage."

(2) Drain fluid from transmission.

(3) Disconnect propeller shaft at rear universal joint, marking parts to reinstall in same position. Carefully pull shaft yoke out of transmission extension housing.

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

(4) Disconnect speedometer cable and back-up lamp switch leads.

(5) Install engine support fixture C-3487-A. Be sure

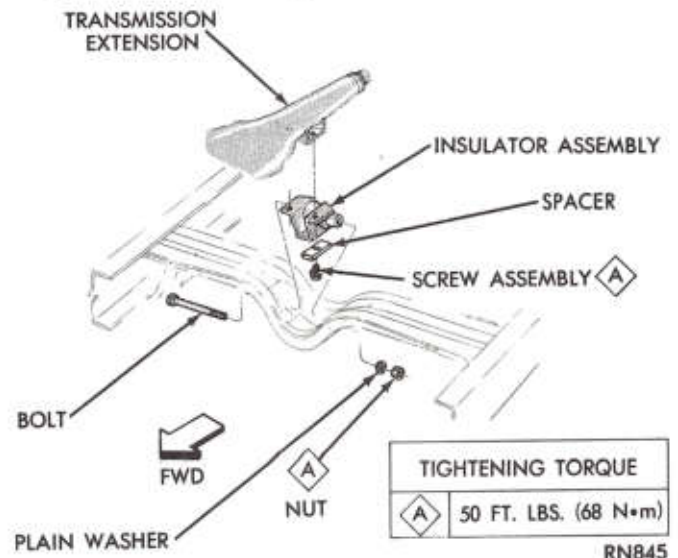
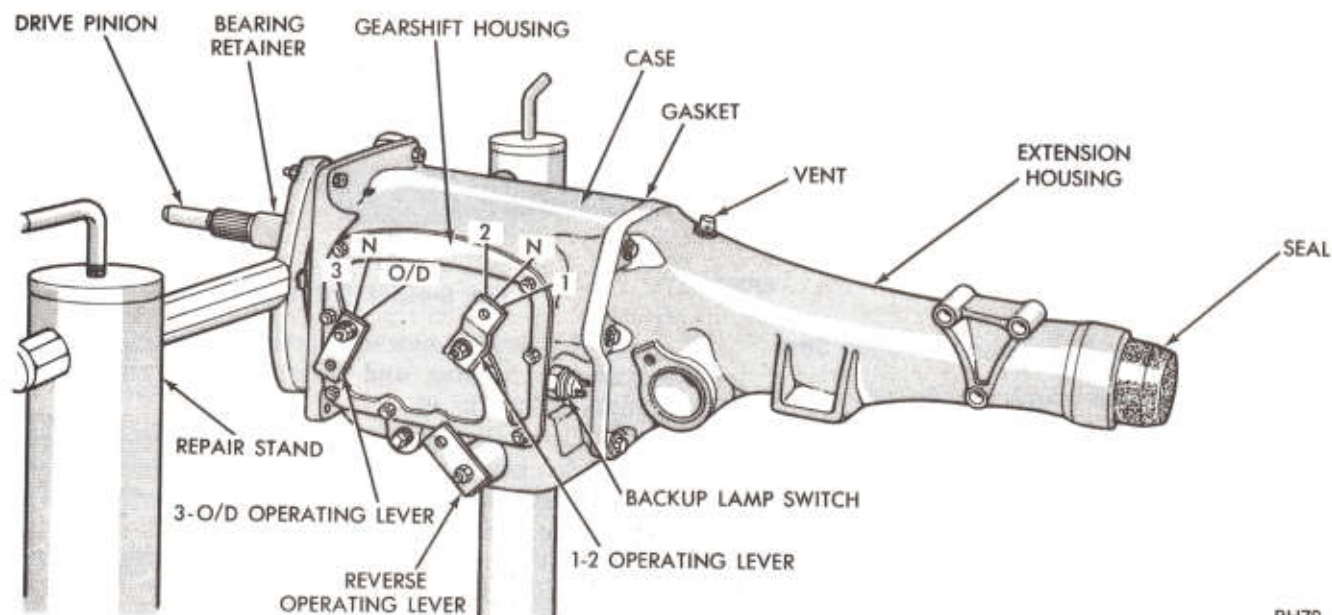


Fig. 10—Engine Rear Mount



RH79

Fig. 11—Transmission in Repair Stand

support ends are up against underside of oil pan flange.

(6) Raise engine slightly with support fixture. Disconnect extension housing from removable center crossmember (Fig. 10).

(7) Support transmission with a suitable jack and remove center crossmember.

(8) Remove transmission to clutch housing bolts. Slide transmission toward rear until drive pinion

shaft clears clutch disc, before lowering transmission.

(9) Lower transmission and remove from under vehicle. Thoroughly clean exterior of unit, preferably by steam. Mount transmission in repair stand (Fig. 11). An adapter mounting plate which enables all four mounting bolts to attach the case to the existing stand will have to be made to enable the transmission to be turned upside down.

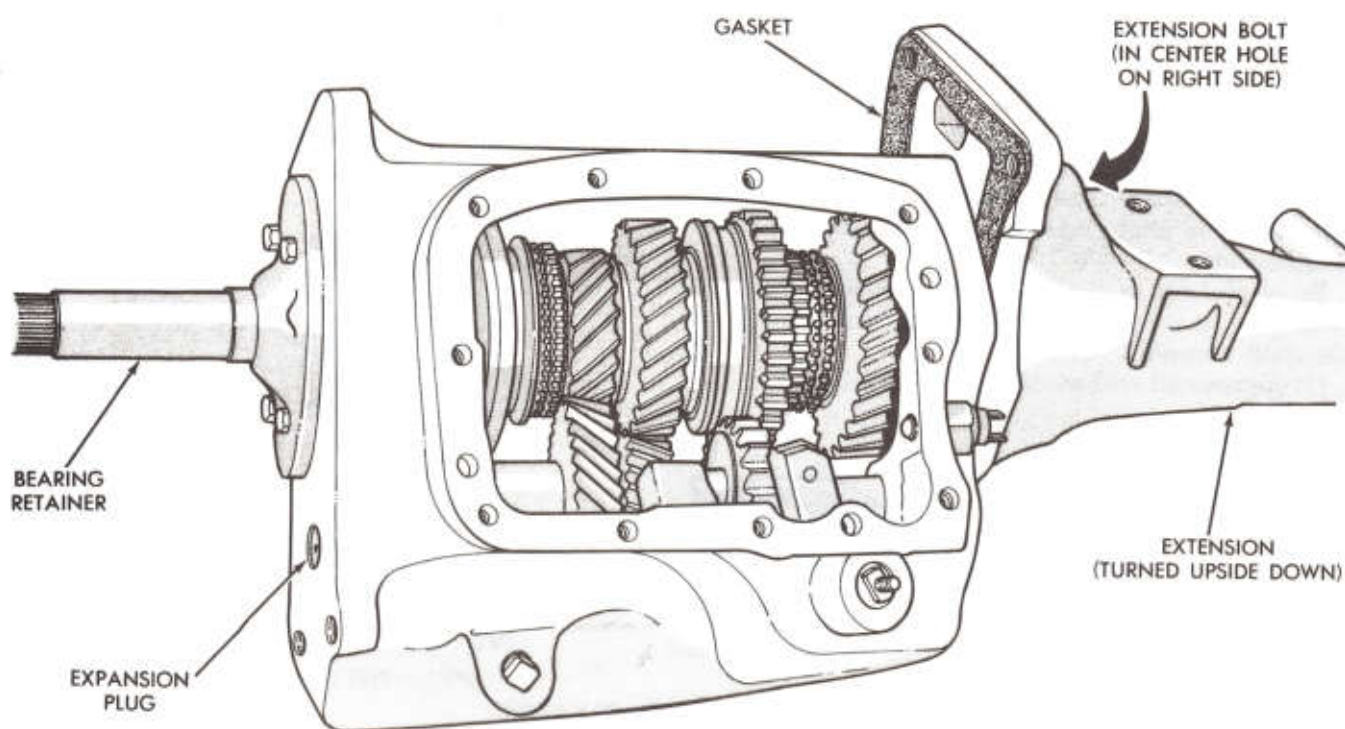


Fig. 12—Rotating Extension Housing

RH80

DISASSEMBLING TRANSMISSION (Fig. 12)

Gearshift Housing and Mechanism

(1) Remove reverse gearshift operating lever from shaft. Remove bolts that attach gearshift housing to transmission case (Fig. 11).

(2) With operating levers in neutral detent position, pull housing out and away from the case. (The 2 shift forks may remain in engagement with synchronizer sleeves). Work forks out of sleeves and remove from the case. The following 3 steps need only be done if oil leakage is visible around gearshift lever shafts, or the interlock levers are cracked:

(3) Remove nuts that attach shift operating levers to the shafts. Disengage levers from flats on shafts and remove levers.

Make sure shafts are free of burrs before removal, otherwise the bores may be scored resulting in leakage after reassembly.

(4) Pull gearshift lever shafts out of housing.

(5) Remove O-ring retainers and O-rings from housing.

(6) Remove E-ring from interlock lever pivot pin and remove interlock levers and spring from housing (Fig. 14).

(7) Remove reverse detent spring and ball from bore in side of case (Fig. 23).

Extension Housing, Mainshaft, and Drive Pinion

(1) Remove bolt and retainer securing speedometer pinion adapter in extension housing (Fig. 5). Carefully work adapter and pinion out of extension housing.

(2) Remove bolts that attach extension housing to transmission case.

(3) Rotate the extension on the output shaft to expose the rear of the countershaft. Clearance has been provided on extension flange to enable one bolt to be reinstalled to hold the extension in the upside down position with access to the countershaft (Fig. 12).

(4) With a centerpunch or drill, make a hole in the countershaft expansion plug at the front of the case.

(5) Reaching through this hole push the countershaft rearward until woodruff key is exposed. Remove key. Push countershaft forward against the expansion plug. Using a brass drift, tap the countershaft forward until expansion plug is driven out of case.

(6) Using the countershaft arbor Tool C-3938, push countershaft out of rear of case, using care to insure that the countershaft washers don't fall out of position. Lower countershaft gear to bottom of case.

(7) Rotate the extension back to normal position.

(8) Remove drive pinion bearing retainer attaching bolts. Slide retainer and gasket from pinion shaft (Fig. 1). Pry oil seal from retainer. To avoid leakage around new seal, do not nick or scratch seal bore in the retainer or the surface on which the seal bottoms.

(9) Using a brass drift, tap the pinion and bearing assembly forward and remove through front of case.

(10) Slide third and overdrive (O/D) synchronizer sleeve slightly forward, slide reverse idler gear to center of its shaft, then using a soft-faced hammer, tap on extension housing (in a rearward direction). Slide housing and mainshaft assembly out and away from the case (Fig. 15).

(11) Refer to Figure 16 for location of various gears, synchronizer sleeves and clutches before disassembling mainshaft.

(12) Remove snap ring (Fig. 17), that retains 3rd and O/D synchronizer clutch gear and sleeve assembly to the mainshaft then slide 3rd and O/D synchronizer assembly off end of mainshaft.

(13) Slide O/D gear and stop ring off mainshaft. (Do not separate 3rd and O/D speed synchronizer clutch gear, sleeve shift struts, or springs unless inspection reveals a replacement part is required).

(14) Using a long-nose pliers, compress snap ring that retains mainshaft ball bearings in extension housing (Fig. 18).

(15) Holding snap ring compressed, pull mainshaft assembly and bearing out of the extension housing (Fig. 19).

LEGEND FOR FIGURE 13

- | | | | |
|------------------------------------|---------------------------------------|---------------------------------------|-----------------------------------|
| 1. Bearing Retainer | 21. Snap Ring | 44. Shift Struts (3) | 68. Oil Seal, Reverse Lever Shaft |
| 2. Bearing Retainer Gasket | 24. Baffle | 45. Woodruff Key | 69. Reverse Operating Lever |
| 3. Bearing Retainer Oil Seal | 25. Gasket, Case to Extension Housing | 46. Countershaft | 72. Nut, Lever |
| 4. Snap Ring, Bearing (Inner) | 26. Lockwasher | 47. Thrustwasher, Gear (1) | 73. Gearshift Control Housing |
| 5. Snap Ring, Bearing (Outer) | 27. Bolt | 48. Spacer Ring Needle Roller Bearing | 74. 1st and 2nd Operating Lever |
| 6. Pinion Bearing | 28. Extension Housing | 49. Needle Bearing Rollers | 77. Nut, Lever |
| 7. Transmission Case | 29. Mainshaft Yoke Bushing | 50. Bearing Spacer | 80. 3rd and O/D Operating Lever |
| 8. Filler Plug | 30. Oil Seal | 51. Countershaft Gear (Cluster) | 83. Interlock Lever (2) |
| 9. Gear, 2nd Speed | 31. Main Drive Pinion | 52. Needle Bearing Rollers | 84. E-Clip |
| 10. Snap Ring | 33. Needle Bearing Rollers | 53. Spacer Ring Needle Roller Bearing | 85. Spring |
| 11. Shift Strut Springs | 34. Snap Ring | 54. Thrustwasher, Gear (1) | 86. Oil Seal (2) |
| 12. Clutch Gear | 35. Stop Ring | 60. Spring, Reverse Detent Ball | 87. 3rd and O/D Lever |
| 13. Shift Struts (3) | 36. Snap Ring | 61. Ball, Reverse Detent | 88. 1st and 2nd Lever |
| 14. Shift Strut Spring | 37. Shift Strut Spring | 62. Woodruff Key | 89. 3rd and O/D Speed Fork |
| 15. Snap Ring | 38. Clutch Gear | 63. Reverse Idler Gear Shaft | 90. 1st and 2nd Speed Fork |
| 16. 1st and 2nd Clutch Sleeve Gear | 39. Shift Strut Spring | 64. Bushing, Reverse Idler Gear | 91. Drain Plug |
| 17. Stop Ring | 40. Clutch Sleeve | 65. Gear, Reverse Idler | 92. Gasket, Shift Control Housing |
| 18. 1st Speed Gear | 41. Stop Ring | 67. Reverse Lever | 93. Expansion Plug |
| 19. Snap Ring | 42. OD Gear | | |
| 20. Rear Bearing | 43. Mainshaft (Output) | | |

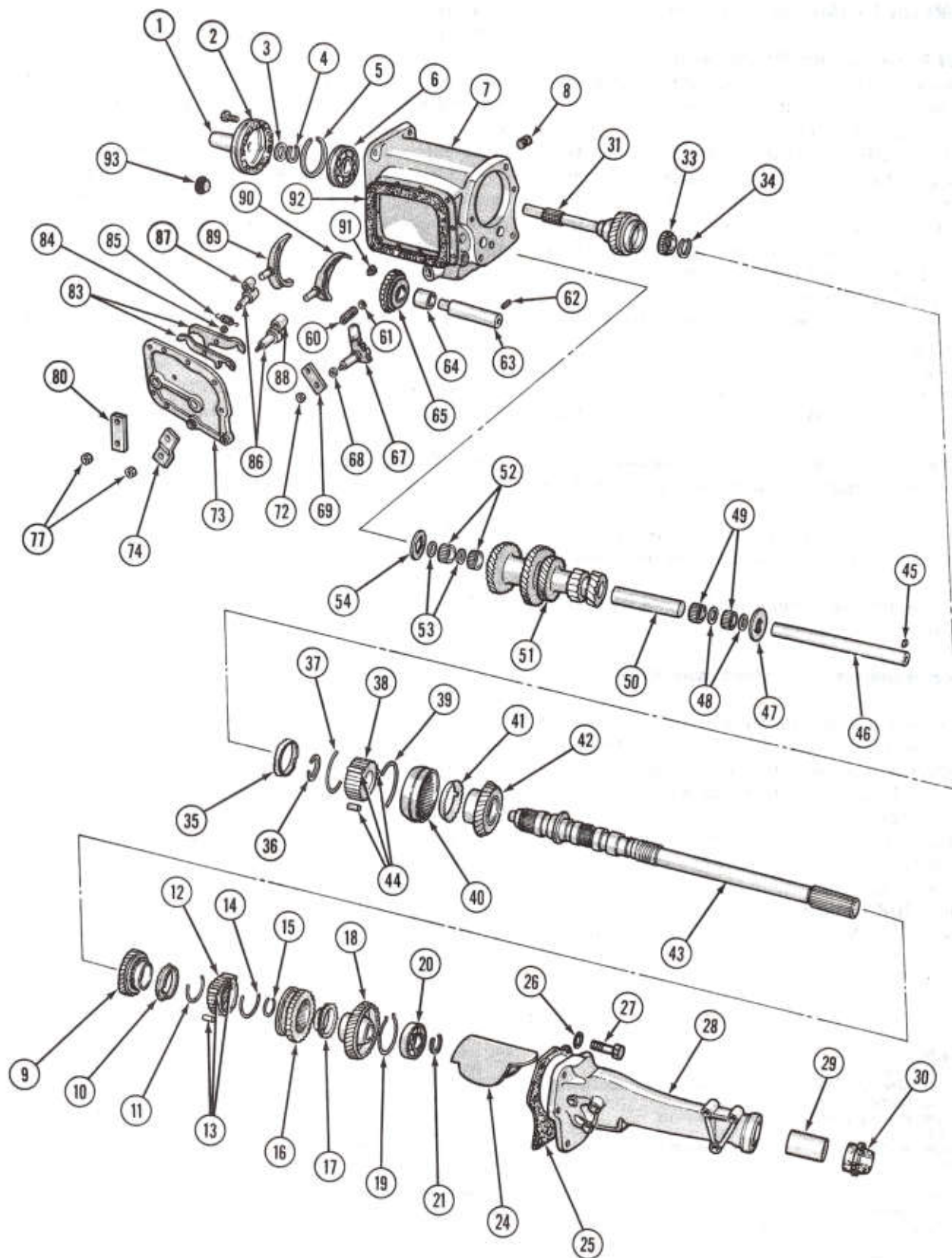


Fig. 13—Overdrive-4 Manual Transmission

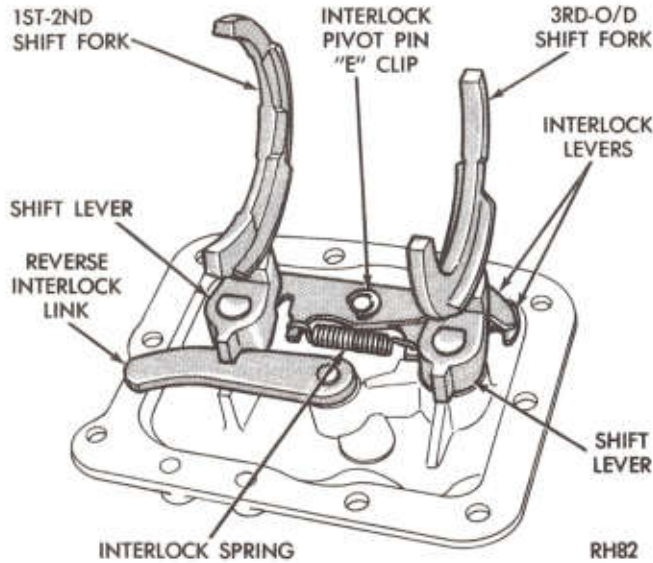


Fig. 14—Gearshift Housing Assembly

(16) Remove snap ring that retains mainshaft bearing on the shaft (Fig. 20).

(17) Remove bearing from mainshaft by inserting steel plates on front side of 1st speed gear, then press

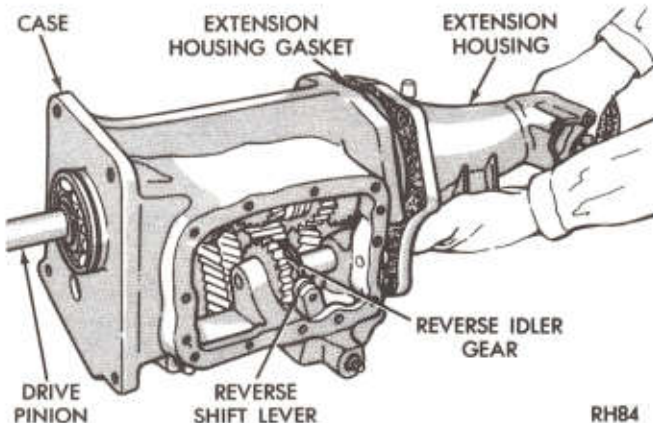


Fig. 15—Remove or Install Extension Housing and Mainshaft Assembly

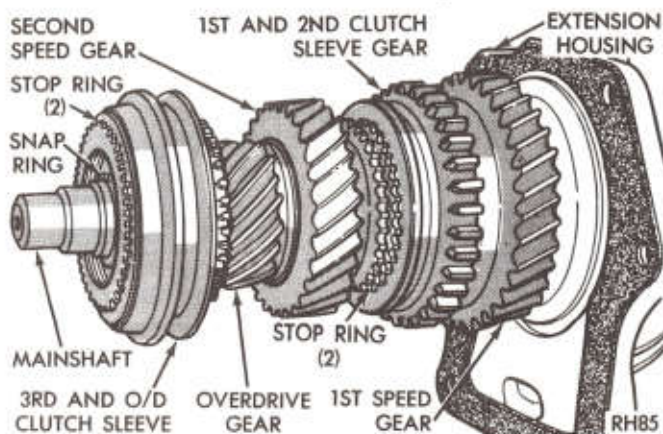


Fig. 16—Mainshaft Gears Identification

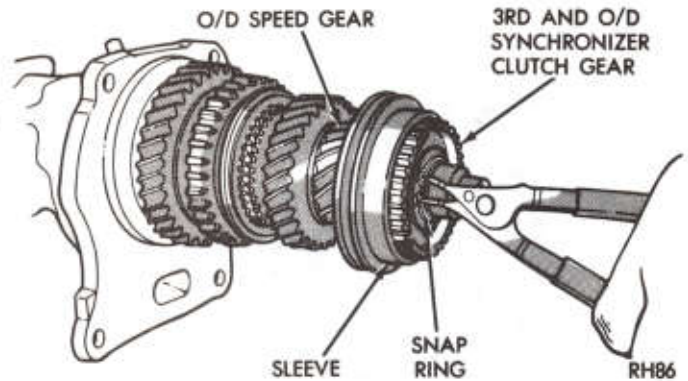


Fig. 17—Disassembling Mainshaft

or drive mainshaft through bearing. (Be careful not to damage gear teeth).

(18) Remove bearing, bearing retainer ring, 1st speed gear, and first speed stop ring from the shaft.

(19) Remove snap ring that retains 1st and 2nd clutch gear and sleeve assembly to mainshaft (Fig. 21).

(20) Slide 1st and 2nd clutch gear and sleeve assembly from mainshaft. (Do not separate synchronizer parts unless inspection reveals a replacement part is required.) Remove 2nd speed gear.

(21) Figure 22 shows various mainshaft bearing

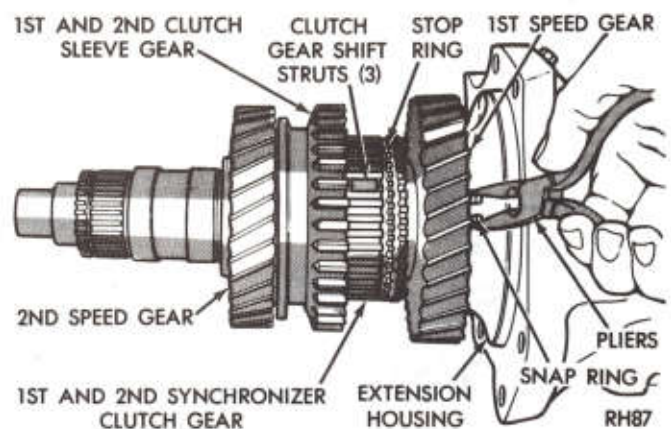


Fig. 18—Mainshaft Bearing Snap Ring

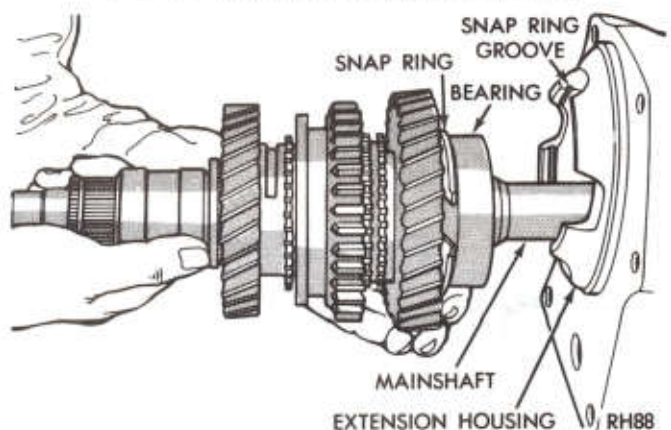


Fig. 19—Remove or Install Mainshaft

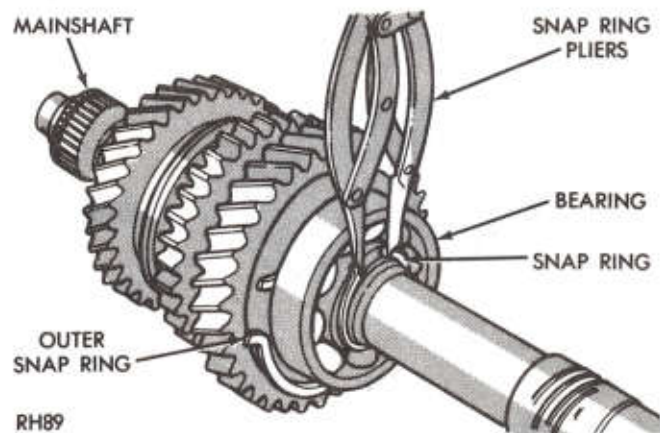


Fig. 20—Mainshaft Bearing

surfaces for the gears. Inspect these surfaces for signs of wear, scoring, or any condition that would not allow shaft to be used at reassembly.

Drive Pinion and Countershaft Gear

- (1) Remove pinion bearing inner snap ring. Using an arbor press, remove bearing from pinion.
- (2) Remove snap ring and 16 bearing rollers from cavity in drive pinion.
- (3) Remove countershaft gear from bottom of case (Fig. 25).
- (4) Remove arbor and 76 needle bearings, thrust washers, and spacers from center of countershaft gear.

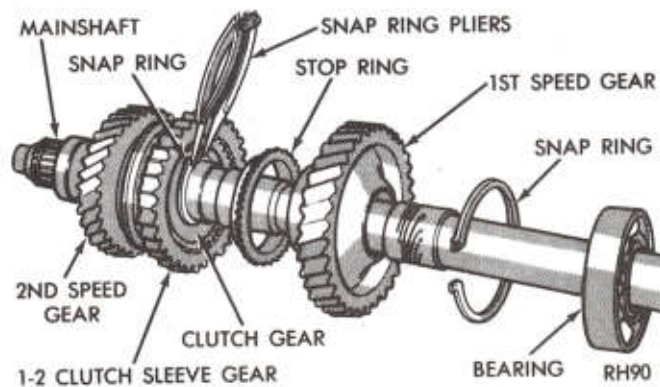


Fig. 21—Clutch Gear Snap Ring

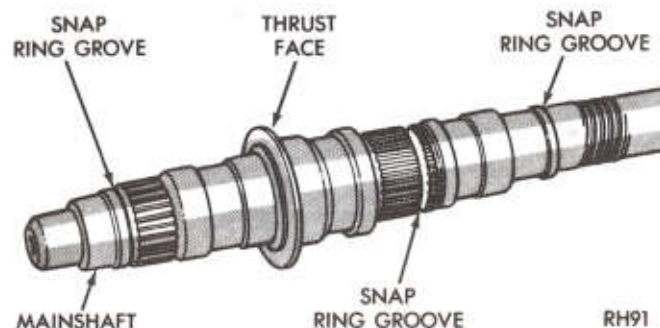


Fig. 22—Mainshaft Bearing Surfaces

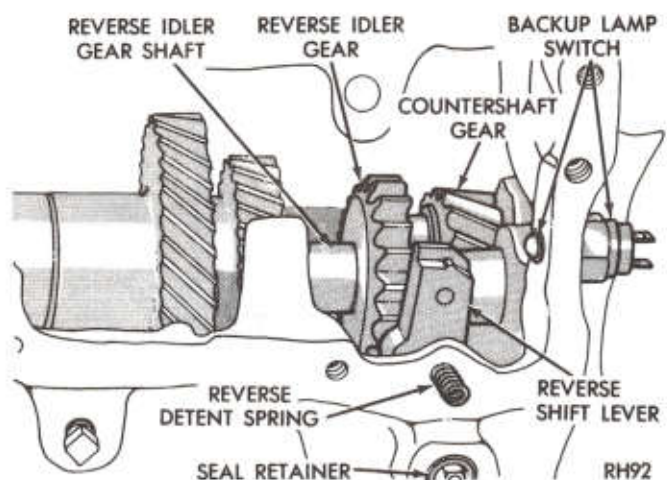


Fig. 23—Gear, Shaft, and Lever Identification

Reverse Gear, Lever, and Fork

- (1) The reverse idler gear shaft is a very tight fit in

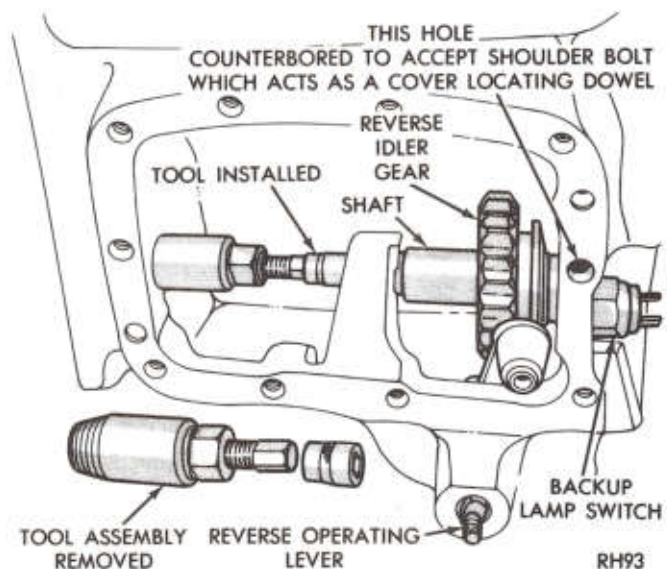


Fig. 24—Remove Reverse Idler Shaft

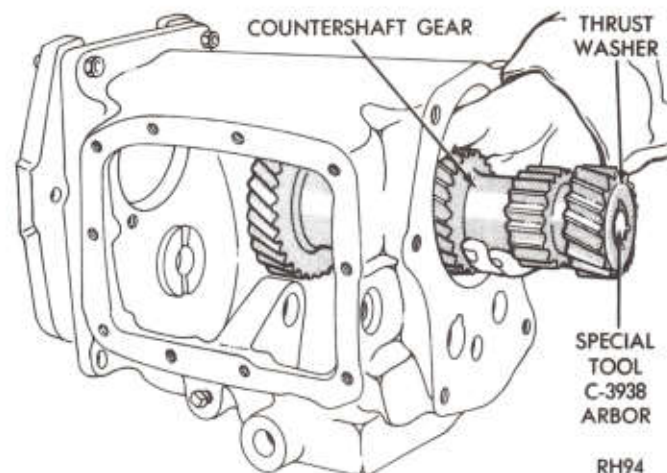


Fig. 25—Remove or Install Countershaft Gear

the case. To remove, place a 7/16 inch socket (1/4 or 3/8 inch drive) on end of Tool C-3638 Power Steering Wormshaft Seal Remover (Fig. 24).

Place tool in case with socket against end of shaft and other end of tool against the case. Turn screw of tool to press shaft out of the case. Remove woodruff key from shaft. In some cases, a 7/16 inch deep socket and/or a 3 inch extension may be required to press shaft completely out of the case.

The following step need only be done if oil leakage is visible around reverse gearshift lever shaft.

(3) Remove any burrs from shaft so as not to damage the case bore, then carefully push the reverse gearshift lever shaft inward and remove it from case. Remove O-ring and O-ring retainer from case bore.

CLEANING AND INSPECTION

Clean transmission case thoroughly, using a suitable solvent and dry with compressed air. The magnetic disc, located on bottom of case, can be removed for cleaning by using a screwdriver to pry off the retaining clip. After cleaning the magnetic disc with a clean cloth, the disc and retaining clip can be reinstalled by pressing the clip onto the rib in the case. Inspect case for cracks, stripped threads in various bolt holes, and machined mating surfaces for burrs, nicks, or any condition that would render the case unfit for further service. The front mating surface should be smooth; if any burrs are present, dress them off with a fine, mill file. If threads are stripped, install Helicoil, or equivalent, inserts.

Ball Bearings

Wash ball bearings, using a clean solvent and blow dry with compressed air.

CAUTION: Do not spin bearings with air pressure; turn slowly by hand. Spinning unlubricated bearings may cause damage to races and balls.

Be sure ball bearings are clean, then lubricate them with light grade engine oil. Inspect bearings for roughness. This can best be determined by slowly turning outer race by hand.

Needle Bearing Rollers and Spacers

Inspect all bearing rollers for flat spots or brinelling. Inspect all bearing roller spacers for signs of wear or galling. Inspect roller contact surfaces of gear and shaft. Install new parts as required.

Gears

Inspect countershaft gear and all gear teeth for chipped or broken teeth, or showing signs of excessive wear. Small nicks or burrs must be stoned off.

Inspect teeth on main drive pinion. If excessively worn, broken, or chipped, a new pinion should be

installed. If the oil seal contact area on drive pinion shaft is pitted, rusted, or scratched, a new pinion is recommended for best seal life.

Inspect interlock levers for cracks at detent and clearance notches at each end of levers. Inspect shift forks for wear on pads and shafts.

Inspect the fork shaft bore in the shift lever for galling.

Synchronizer Assemblies

Inspect spline teeth on synchronizer clutch gears and stop rings. If there is evidence of chipping or excessively worn teeth, install new parts at reassembly. Be sure clutch sleeve slides easily on the clutch gear.

Synchronizer springs should be in place with the tang inside the cavity of one strut and should not show signs of interference with the polished gear cones or inside diameters of the clutch gears.

Inspect stop rings for cracks and wear. If rings are cracked or show signs of extreme wear on threaded bore, install new rings at reassembly. Test new rings for good fit on gear cones with minimum wobble. Check synchronizer struts for wear or breakage.

Synchronizers will be serviced as an assembly. Except for stop rings, synchronizer parts should not be interchanged.

Mainshaft

Inspect mainshaft gear and bearing mating surfaces. If gear contact surfaces show signs of galling or are excessively worn, a new mainshaft should be installed.

Inspect snap ring grooves for burred edges. If rough or burred, remove condition using a fine file or crocus cloth. Inspect synchronizer clutch gear splines on shaft for burrs.

ASSEMBLING TRANSMISSION

Reverse Gear, Lever, and Fork

The following step need only be done if the reverse shaft was removed because of oil leak.

(1) Install reverse shift lever in case bore, followed by greased O-ring and O-ring retainer.

(2) Place reverse idler gear shaft in position in end of case, and drive it in far enough to position reverse idler gear on protruding end of shaft with fork slot toward rear. At same time, engage slot with reverse shift fork.

(3) With reverse idler gear correctly positioned, drive reverse gear shaft into case far enough to install woodruff key. Drive shaft in flush with end of case.

(4) Install back-up lamp switch and gasket. Tighten to 15 ft. lbs. (20 N-m).

Countershaft Gear and Drive Pinion

(1) Coat inside bore of countershaft gear at each end with a thin film of grease and install roller bearing spacer with arbor Tool C-3938 into gear. Center spacer and arbor.

(2) Install 19 rollers, followed by a spacer ring, 19 more roller bearings, and 1 spacer ring into each end of gear (Fig. 13).

(3) If countershaft thrust washers are worn or scored, install new thrust washers. Coat thrust washers with grease and install them over arbor with tang side toward the case boss (Fig. 25).

(4) Install countershaft gear assembly into the case (Fig. 25). Allow gear assembly to rest on bottom of case. (Be sure thrust washers stay in position).

(5) Press drive pinion bearing on pinion shaft. Be sure outer snap ring groove is toward front (Fig. 27). Seat bearing fully against shoulder on gear.

(6) Install a new snap ring on shaft to retain bearing. Be sure snap ring is seated. This snap ring is a select fit for minimum end play.

(7) Place pinion shaft in a vise (with soft jaws), then install 16 bearing rollers in cavity of shaft. Coat bearing rollers with grease, then install bearing retaining snap ring in its groove.

(8) Using Tool C-3789 (Fig. 28), install a new oil seal in retainer bore.

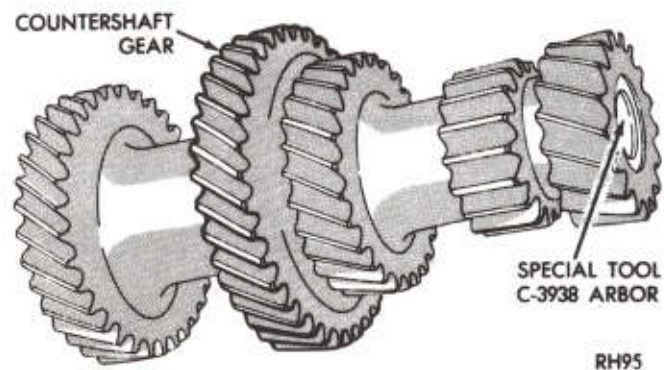


Fig. 26—Countershaft Gear

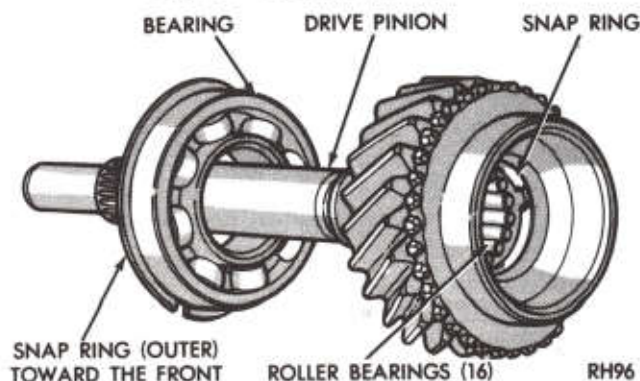


Fig. 27—Drive Pinion Assembly

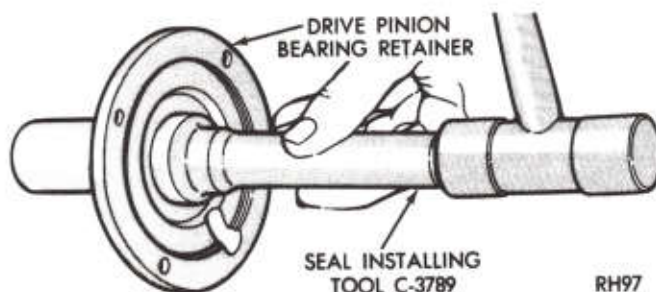


Fig. 28—Install New Oil Seal

EXTENSION HOUSING BUSHING REPLACEMENT

(1) Remove extension housing yoke seal.

(2) Drive the bushing out of housing (Fig. 29) with Tool C-3974.

(3) Slide a new bushing on installing end of Tool C-3974. Align oil hole in bushing with oil slot in housing, then drive bushing into place (Fig. 29).

(4) To install a new seal, position seal in opening of extension housing and drive it into housing with Tool C-3972 (Fig. 9).

Mainshaft

(1) Subassemble the synchronizer parts in the order shown in (Figs. 30 and 31) as follows: Place a stop ring flat on the bench followed by the clutch gear and

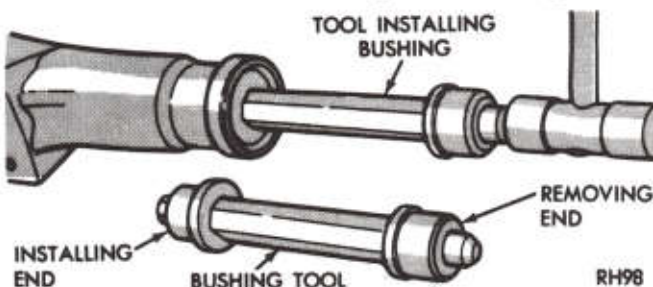


Fig. 29—Replacing Extension Housing Bushing

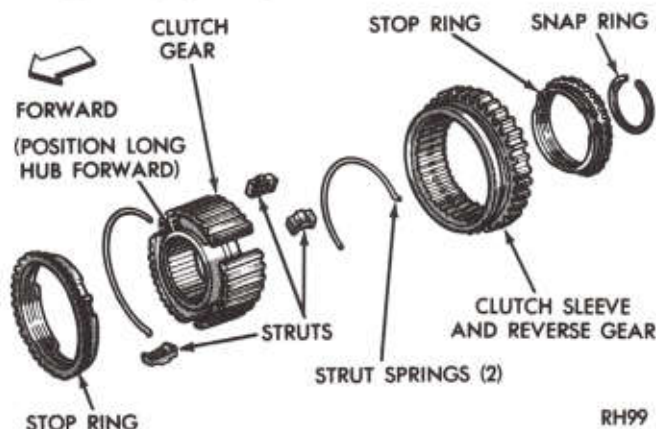


Fig. 30—1st-2nd Synchronizer

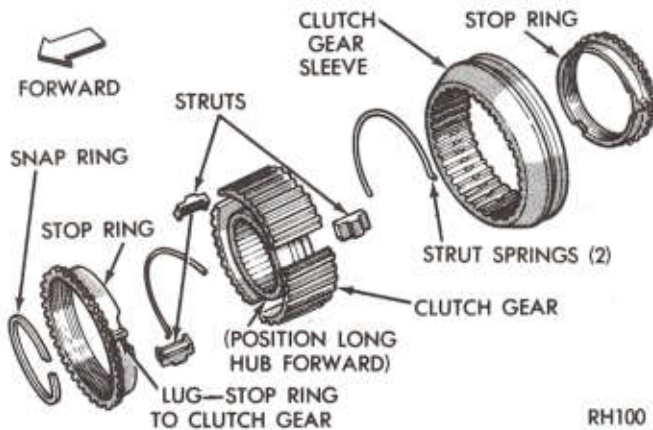


Fig. 31—3rd-O/D Synchronizer

sleeve. Drop the struts in their slots and snap in a strut spring placing the tang inside one strut. Turn the assembly over on the stop ring and install second strut spring tang in a different strut.

(2) Slide second speed gear over mainshaft (synchronizer cone toward rear) and down against shoulder on shaft (Fig. 21).

(3) Slide 1st-2nd synchronizer assembly (including stop ring with lugs indexed in hub slots (Fig. 30), over mainshaft, down against second gear cone and secure with a new snap ring (Fig. 21). Slide next stop ring over shaft and index lugs into clutch hub slots.

(4) Slide 1st speed gear (synchronizer cone toward clutch sleeve gear just installed) over mainshaft into position against clutch sleeve gear.

(5) Install mainshaft bearing retaining ring, followed by mainshaft rear bearing. Using an arbor and a suitable tool, drive or press bearing down into position. Install a new snap ring on shaft to secure bearing (Fig. 20). This snap ring is a select fit for minimum end play.

(6) Install partially assembled mainshaft into extension housing far enough to engage bearing retaining ring in slot in extension housing (Fig. 19). Compress outer snap ring with pliers so that mainshaft ball bearing can move in and bottom against its thrust shoulder in extension housing. Release outer snap ring and seat it all around its groove in extension housing (Fig. 18).

(7) Slide overdrive gear over mainshaft (with synchronizer cone toward front) followed by O/D gear stop ring (Fig. 17).

(8) Install 3rd-O/D synchronizer clutch gear assembly (including sleeve, shift struts and springs) on mainshaft (shift fork slot toward rear) against O/D gear (Fig. 17). Be sure to index rear stop ring with clutch gear struts.

(9) Install retaining snap ring (Fig. 17). Then, using grease, position front stop ring over clutch gear, again indexing ring lugs with struts.

(10) Coat a new extension gasket with grease, then place it in position on the extension.

(11) To provide clearance so that assembly will be possible, slide reverse idler gear to center of its shaft and move the 3rd O/D synchronizer sleeve as far forward as practical (do not lose struts).

(12) Now slowly insert mainshaft assembly into case (Fig. 15) tilting it as required to clear idler and cluster gears.

(13) Place 3rd-O/D synchronizer sleeve in neutral position.

(14) Rotate the extension on mainshaft to expose rear of countershaft. Install one extension bolt as shown in Figure 12, to hold extension in inverted position and prevent it from moving rearward.

(15) Install drive pinion and bearing assembly through the front of the case and position in the front bore. Install outer snap ring in bearing groove. Tap lightly into place using a soft-faced hammer. If everything is in proper position, the bearing outer snap ring will bottom onto the case face without excessive effort. If not, check to see if a strut, pinion roller, or stop ring is out of position.

(16) Turn transmission assembly upside down, holding the countershaft gear assembly to prevent damaging it.

(17) Lower the countershaft gear assembly into position with the teeth meshed with the drive pinion gear. Make sure thrust washers remain in position on ends of the arbor and tangs are aligned with slots in case.

(18) Start the countershaft into bore at rear of case and push forward until the shaft is approximately half way into the case and gear. Install woodruff key. Push shaft forward until end is flush with rear of case face. Remove arbor Tool C-3938.

(19) Rotate extension into proper alignment with the case.

(20) Install extension housing bolts and tighten to 50 ft. lbs. (68 N-m).

(21) Rotate transmission assembly to normal position.

(22) Install drive pinion bearing retainer with a new gasket. Coat threads with sealing compound, then install attaching bolts and tighten to 30 ft. lbs. (41 N-m) (Fig. 2).

(23) Install new expansion plug in countershaft bore in front of case.

Gearshift Housing and Mechanism (Fig. 32)

(1) Install interlock levers on pivot pin and fasten with E-ring. Use pliers to install spring on interlock lever hangers.

(2) Grease housing bores and push each shaft into its proper bore followed by greased O-ring and O-ring retainer.

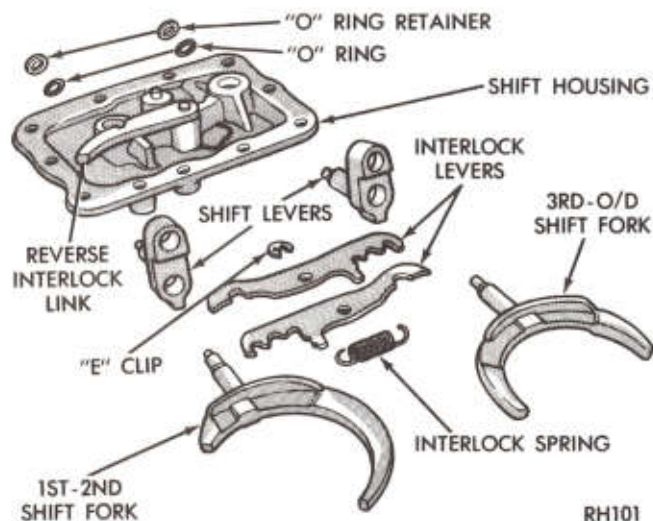


Fig. 32—Shift Housing

(3) Install operating levers and tighten retaining nuts to 18 ft. lbs. (24 N·m). Be sure 3rd-O/D operating lever points downward.

(4) Rotate each shift shaft fork bore to neutral position (straight up) and install the 3rd-O/D shift fork in its bore and under both interlock levers.

(5) Position both synchronizer sleeves in neutral. Place the 1-2 shift fork in groove of 1-2 synchronizer sleeve. Slide reverse idler gear to neutral.

(6) Lay transmission on its right side and position gasket using grease to retain it.

(7) Install reverse detent ball followed by the detent spring into its bore in side of case.

(8) As the shift housing is lowered in place, guide the 3rd-O/D shift fork into its synchronizer groove, then lead the shaft of the 1-2 shift fork into its bore in the 1-2 shift lever. Hold the reverse interlock link against the 1-2 shift lever to provide clearance as the shift cover is lowered into position.

To finish the installation, a screwdriver must be used to raise the interlock lever against its spring tension to allow the 1-2 shift fork shaft to slip under the levers. Be sure reverse detent spring is positioned in the cover bore. The shift housing will now seat against the case gasket.

(9) Install housing retaining bolts finger tight and shift through all gears to insure proper operation.

(10) Eight of the shift housing retaining bolts are shoulder bolts for accurately locating the mechanism on the transmission. One bolt shoulder is longer and acts as a dowel, passing through the cover and into the transmission case at center of rear flange (Fig. 24). Two bolts are standard, located at lower rear of cover. Tighten all bolts evenly to 15 ft. lbs. (20 N·m).

(11) The reverse shift lever and 1-2 shift lever have cam surfaces which mate in reverse position to lock the 1-2 lever, fork, and synchronizer in neutral position. Slight motion of the 1-2 operating lever toward

low gear is normal during shifting into reverse gear.

(12) Grease reverse shaft and install the operating lever and nut. Tighten to 18 ft. lbs. (24 N·m) (Fig. 11).

(13) Shift the transmission into each gear to insure correct shift travels and smooth action.

(14) Install speedometer drive pinion gear and adapter being sure range number, representing number of teeth on gear, is in 6 o'clock position (Fig. 5).

TRANSMISSION INSTALLATION

The transmission pilot bushing in end of crankshaft requires a grease which will stay in place during high temperature operation. Use MOPAR Multipurpose Grease, Part Number 4318063 or equivalent, which is a grease of this type.

Place a small amount of Multipurpose lubricant around inner end of pinion shaft pilot bushing in flywheel and on pinion bearing retainer release bearing sleeve area. Do not lubricate end of pinion shaft, clutch disc splines, or clutch release levers.

(1) With transmission on a suitable jack, slide assembly under vehicle.

(2) Raise transmission until drive pinion is centered in clutch housing bore.

(3) Roll transmission slowly forward until pinion shaft enters clutch disc. With transmission in gear, turn output shaft until splines are aligned, then push transmission forward until seated against clutch housing. Do not allow transmission to "hang" after pinion has entered the clutch disc.

(4) Install transmission to clutch housing bolts and tighten to 50 ft. lbs. (68 N·m). Remove the jack.

(5) Using a pointed drift, align crossmember bolt holes, then install attaching bolts. Tighten to 30 ft. lbs. (41 N·m) (Fig. 10).

(6) Remove engine support fixture. Install extension housing to engine rear mount bolts and tighten to 50 ft. lbs. (68 N·m). The engine mount to center crossmember bolt and nut, loose assembled to this point, should now be tightened to 50 ft. lbs. (68 N·m).

(7) Fasten shift unit to extension housing mounting plate with two bolts and lock washers and tighten to 24 ft. lbs. (33 N·m). Referring to "Gearshift Linkage Adjustment" connect shift control rods to transmission levers and connect speedometer cable.

(8) Carefully guide front universal joint yoke into extension housing and onto mainshaft splines. Connect propeller shaft to rear axle pinion yoke aligning marks made at removal.

(9) Fill transmission with "DEXRON II" type automatic transmission fluid. See Lubrication, Group "O" for details.

(10) Lower vehicle, install gearshift lever and console, refer to "overdrive-4 Gearshift Linkage".

(11) Road test vehicle to make sure transmission shift smoothly and operates quietly.

4-SPEED TRANSMISSION — NP435

INDEX

	Page		Page
Assembly of Subassemblies	32	Removal of Subassemblies	29
Disassembly of Subassemblies	31	Removal of Transmission	29
General Information	29	Service Diagnosis	17
Installing Subassemblies	32	Service Procedures	29
Installing Transmission	34		

GENERAL INFORMATION

The New Process Model 435 four-speed transmission is provided with a direct mounted shift lever and cover. Second, third, and fourth gears are synchronized, helical type constant mesh. First and reverse gears are spur type. Reverse idler is serviced as an assembly complete with integral bearings. Countershaft with gears is integral one-piece design.

A ball bearing supports the main drive pinion. A pilot roller bearing recessed in the main drive pinion

supports the front end of the mainshaft with the rear end supported by a ball bearing.

Front synchronizer is a unit consisting of a sliding clutch gear, energizer springs, floating solid pins, with synchronizer cones and is serviced as an assembly. This is used with wider flange, outer stop rings, replaceable separately. These stop rings must always be used in sets with the new floating solid pin type synchronizer.

SERVICE PROCEDURES

TRANSMISSION REMOVAL

The shift lever retainer is removable by pressing down, rotating the retainer counterclockwise slightly, then releasing (Fig. 1).

Remove transfer case (if so equipped) as follows:

- (1) Remove 4 bolts attaching skid plate rear cross member to underside of frame, if so equipped.
- (2) Remove 5 bolts attaching front end of skid plate to transmission cross member. Remove skid plate.
- (3) Disconnect speedometer cable.
- (4) Disconnect front and rear output shafts (support

each shaft, do not allow shafts to hang).

- (5) Disconnect shift rods at transfer case.

(6) With suitable jack, support transfer case. Be sure transfer case is safely secured in removing device.

(7) Remove extension to transfer case mounting bolts.

(8) Move transfer case rearward to disengage front input spline.

(9) Lower transfer case assembly and remove from under vehicle.

- (10) Disconnect back-up lamp switch lead.

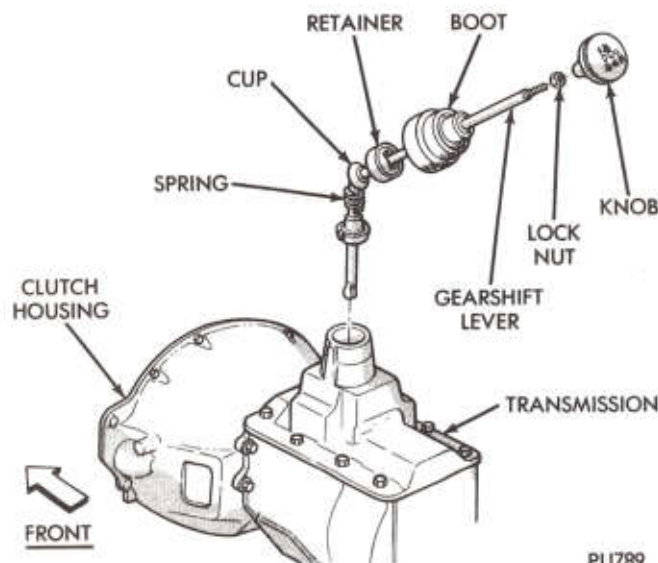
(11) Install engine support fixture C-3487A, with adapter Tool DD-1279 firmly over frame rails. Be sure support ends are up against underside of oil pan flange.

- (12) Support transmission with a suitable jack.

- (13) Remove transmission crossmember.

(14) Remove transmission to clutch housing bolts. Slide transmission toward rear until drive pinion shaft clears clutch disc, before lowering transmission.

(15) Lower transmission and remove from under vehicle. Thoroughly clean exterior of unit.



PU789

Fig. 1—NP435 Transmission Controls

REMOVAL OF SUBASSEMBLIES (Fig. 2)

Shift Cover and Parking Brake

- (1) Mount transmission in holding fixture.
- (2) Shift gears into neutral by replacing gear shift lever temporarily, or using bar or screwdriver.
- (3) Remove cover screws. (Second screw from front on each side is shouldered with split washer for installation alignment).



Fig. 2—NP435 Transmission

(4) While lifting cover, rotate slightly counterclockwise to provide clearance to shift forks and remove cover.

(5) Remove extension housing.

Synchronizer End Play Check

(1) Before removal and disassembly of drive pinion and mainshaft measure end play between synchronizer outer stop ring and third speed gear (Fig. 3). **Record reading for reference during build-up.** Note deviation from ideal .050 to .070 inch allowable end play so that correction shims can be installed during assembly. Thick or thin shims are available as required.

Drive Pinion

(1) Remove drive pinion bearing retainer.

(2) Rotate the drive pinion gear to align space in pinion gear clutch teeth with countershaft drive gear teeth. Remove drive pinion gear and ball bearing from transmission. (Pull on pinion shaft, rap face of case with brass hammer).

(3) Remove snap ring, washer, and pilot roller bearings from recess in drive pinion gear.

Mainshaft

(1) Place a brass drift in front center of mainshaft and drive mainshaft to rear.

(2) When mainshaft rear bearing has cleared case remove rear bearing with a suitable puller.

(3) Move mainshaft assembly to rear and tilt front of mainshaft up.

(4) Remove roller type thrust bearing.

(5) Remove synchronizer and stop rings separately.

(6) Remove mainshaft assembly.

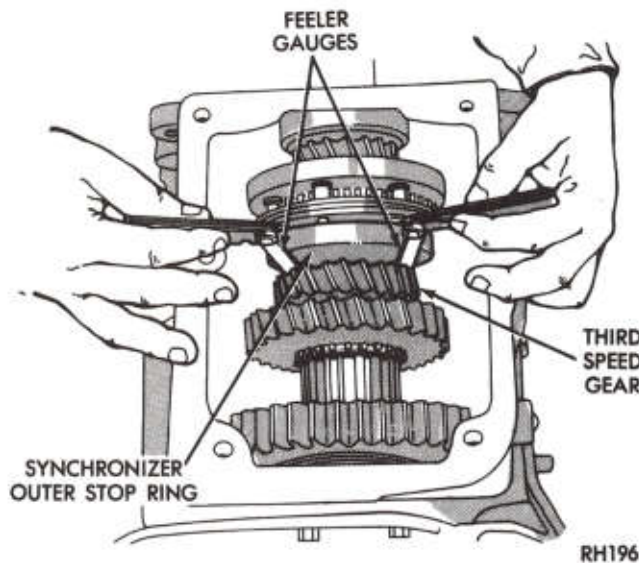


Fig. 3—Measuring Synchronizer End Play

Reverse Idler Gear

(1) Remove reverse idler lock screw and lock plate.

(2) With brass drift held at angle, drive idler shaft to rear and pull shaft.

(3) Lift reverse idler gear from case.

Countershaft Gear

If excessive side play and end play are not found and teeth are not badly worn or chipped, countershaft gear may not require replacement. However, if continued use seems impaired, remove as follows:

(1) Remove bearing retainer at rear end of countershaft. The roller bearing assembly at rear end of shaft remains with retainer.

(2) Tilt countershaft gear assembly and work out of case.

(3) Using a suitable driver, remove front bearings from case.

DISASSEMBLY OF SUBASSEMBLIES (Fig. 2)

Mainshaft

(1) Remove clutch gear snap ring.

(2) Remove clutch gear, synchronizer outer stop ring to third speed gear shim(s), and third speed gear.

(3) Remove special split lock ring with two screwdrivers. Remove second speed gear and synchronizer.

(4) Remove first and reverse sliding gear.

Reverse Idler Gear

(1) Do not disassemble. If no longer serviceable replace as an assembly complete with integral bearings.

Cover and Shift Forks Assembly (Fig. 5)

Cover and shift forks should be disassembled only if rails, poppets, or interlock plungers are worn or springs broken allowing end play or simultaneous movement

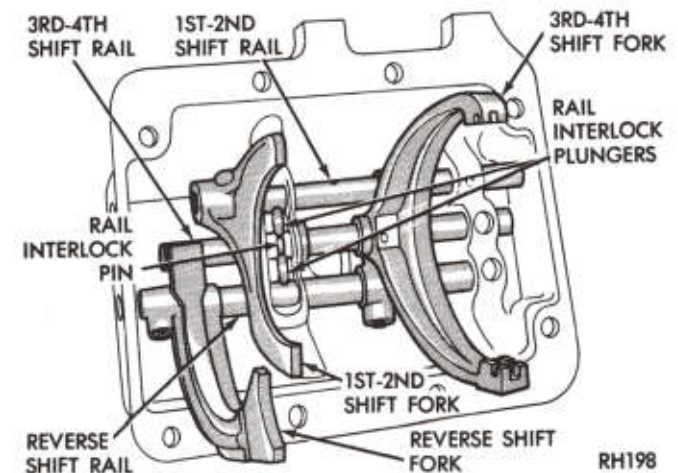


Fig. 4—Cover and Shift Fork Assembly

of rails, and if shift forks or cover itself need replacing. Observe these parts for wear as disassembly takes place.

(1) Remove roll pin from first and second speed shift fork. Remove roll pin from gate in the same manner. A square type or closely wound spiral "easy-out" mounted in a tap handle is preferable for this operation.

(2) Push shift rail out through the front to force expansion plug out of cover. Cover detent ball access hole in cover with cloth to prevent ball and spring from flying as rail clears hole. Remove rail, fork, and gate.

(3) Remove third and fourth speed rails in the same manner, then remove reverse rail.

(4) Compress reverse gear plunger (Fig. 5) and remove retaining clip. Remove plunger and spring from gate.

Drive Pinion and Bearing Retainer

(1) Remove ball bearing from pinion shaft with suitable tool.

(2) Remove snap ring, washer and pilot rollers from gear bore (if not previously removed).

(3) Remove pinion shaft seal, with suitable seal remover.

ASSEMBLY OF SUBASSEMBLIES (Fig. 2)

In performing assembly operations, use new expansion plugs, gaskets and seals. Lubricate all parts with transmission lubricant before assembly. Where grease is specified as an assembly aid in holding parts together, use an oil soluble grease such as Multi-purpose Grease NLGI Grade 2, or equivalent. Make certain that oil returns are not plugged with grease.

Mainshaft

(1) Place mainshaft in soft-jawed vise with rear end up.

(2) Install first and reverse speed gear. Be sure the two spline springs (if used) are in place inside gear as it is placed on shaft.

(3) Place mainshaft in a soft-jawed vise with forward end up.

(4) Assemble second speed synchronizer spring and synchronizer to second speed gear. Secure with snap ring making sure that snap ring tangs are away from gear.

(5) Slide second speed gear onto front of output shaft making sure that synchronizer is toward rear. Secure gear to shaft with two-piece lock ring. Install third speed gear.

(6) Install shim(s) between third speed gear and third and fourth speed synchronizer stop ring. Refer to end play measurement recorded at this point during disassembly and determine additional or necessary shims to bring end play into tolerance (.050 to

.070 inch). **Exact determination of end play must be finally made after complete assembly of mainshaft and main drive pinion is accomplished in the transmission case.**

Reverse Idler Gear

(1) No assembly required. If no longer serviceable, replace as an assembly complete with integral bearings.

Drive Pinion and Bearing Retainer

(1) Coat roller bearings with light film of grease to hold rollers in place and insert in pocket of drive pinion gear.

(2) Install washer and snap ring.

(3) Press a new oil seal into place in bearing retainer. Make sure lip of seal is toward mounting surface (rearward).

Cover and Shift Forks (Fig. 5)

(1) Assemble spring on reverse gear plunger and hold it in reverse shift gate. Compress it in gate and install retaining clip.

(2) Enter reverse shift rail in cover and place detent spring and ball in position. Depress ball and slide rail over it.

(3) Install gate and fork on rail. Install a **new** roll pin in gate and in fork.

(4) Place reverse fork in neutral position.

(5) Install the two interlock plungers in their bores.

(6) Insert the interlock pin in the third and fourth speed shift rail. Install rail in the same manner as reverse shift rail.

(7) Install first and second speed shift rail in the same manner making sure the interlock plunger is in place.

(8) Check interlocks by shifting reverse shift rail into reverse position. It should not be possible to shift the other shift rails when this rail is shifted.

(9) If shift lever is to be installed at this point lubricate spherical ball seat and place cap in place.

(10) Install back-up lamp switch.

(11) Install new expansion plugs in bores of rail holes. Install rail interlock hole plug.

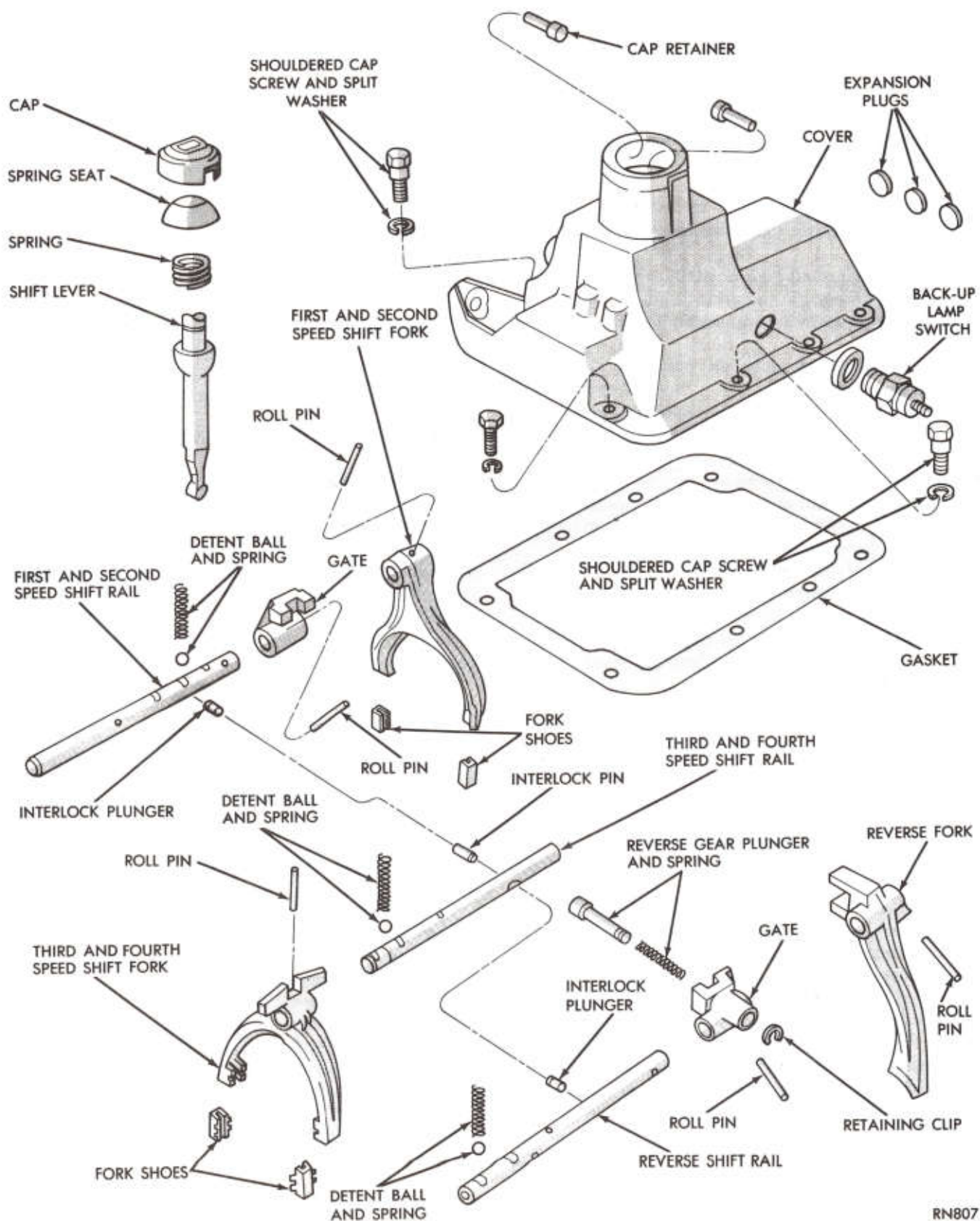
INSTALLING SUBASSEMBLIES

Countershaft

(1) Press front roller bearing into case until cage is flush with front of case. Lubricate roller bearings with light coating of grease.

(2) Place transmission with front of case facing down. If uncaged bearings are reused, hold loose rollers in place in cap with light film of grease (not required with caged type).

(3) Lower countershaft assembly into case placing



RN807

Fig. 5—Cover and Shift Forks

thrust washer tangs in slots in case, and inserting front end of shaft into bearing.

(4) Place roller thrust bearing and race on rear end of countershaft, holding in place with light coating of grease.

(5) While holding gear assembly in alignment install rear bearing retainer gasket, retainer and bearing assembly. Install and tighten cap screws.

Reverse Idler Assembly

(1) Position reverse gear and bearing assembly in case.

(2) Align idler shaft so lock plate groove in shaft is in proper alignment to install lock plate.

(3) Tap shaft into case far enough to start reverse gear.

(4) While holding gear in position, tap shaft through case and gear.

(5) Install lock plate, washer, and cap screw.

(6) Make sure gear turns freely on shaft.

Mainshaft and Drive Pinion

(1) Lower rear end of pre-assembled mainshaft into case holding first speed gear on shaft and maneuver shaft through rear bearing opening.

(2) With shaft assembly moved to rear of case be sure third and fourth speed synchronizer and pre-selected shims remain in position.

(3) Install roller type thrust bearing.

(4) Place a wooden block in between front of case and front of mainshaft.

(5) Install rear bearing on mainshaft by carefully driving bearing onto shaft and into case (snap ring flush against case) using a suitable sleeve against inner race of bearing.

(6) Install drive pinion and ball bearing assembly making sure pilot rollers remain in place.

(7) Install rear bearing retainer and gasket.

(8) Install drive pinion bearing retainer with gasket.

(9) Check the synchronizer end play clearance (.050 to .070 inch) after all mainshaft components are in position and properly tightened. Two sets of equal feeler gauges are used to measure clearance, (Fig. 3). Care should be used to keep gauges as close as possible to both sides of the mainshaft for best results. **In some cases, it may be necessary to disassemble mainshaft again and change the thickness of the shims to keep the end play clearance within the specified (.50 to .070 inch).** Shims are available in two thicknesses.

(10) Shift gears and/or synchronizer into all speed positions and check for free rotation.

Cover

Before installing cover, take pressure type oil can and fill with transmission lubricant. Then, oil all exposed transmission parts to avoid damage at start-up after initial transmission fill.

(1) Move gears into neutral position.

(2) Lower cover with new gasket on case, over transmission.

(3) Carefully engage forks into proper gears and lower cover into place.

(4) Install one shouldered alignment screw and split washer in each second-from-front hole on each side of cover and try gears for free rotation by shifting gears through cover tower with a long screwdriver.

(5) Install remaining cover screws.

TRANSMISSION INSTALLATION

The transmission pilot bushing in end of crankshaft requires a grease which will stay in place during high temperature operation. Use MOPAR Multipurpose Grease Part Number 4318063, or equivalent, which is a grease of this type. Do not lubricate end of pinion shaft, clutch disc splines or clutch release levers.

(1) With transmission on a suitable jack, slide assembly under vehicle.

(2) Raise transmission until drive pinion is centered in clutch housing bore.

(3) Roll transmission slowly forward until pinion shaft enters clutch disc. Turn pinion shaft until splines are aligned, then work transmission forward until seated against clutch housing. **Do not allow transmission to "hang" after pinion shaft has entered the clutch disc.**

(4) Install transmission to clutch housing bolts and tighten to 105 ft. lbs. (142 N·m).

(5) Install transmission rear mount assembly to crossmember. Install crossmember.

(6) Remove engine support fixture and disengage hooks from the frame side rails.

(7) Install shift lever.

(8) Install transfer case (if so equipped). (See "Transfer Case" for installation procedure).

(9) Fill transmission. See Lubrication Section for detailed recommendations.

(10) Road test vehicle to make sure transmission shifts smoothly and operates quietly.

LOADFLITE TRANSMISSIONS

A-904T, A-999, and A-727

CONTENTS

GENERAL INFORMATION Page 35 DIAGNOSIS AND TESTS 40 MAINTENANCE AND ADJUSTMENTS 62	SERVICE IN VEHICLE Page 65 SERVICE OUT OF VEHICLE 75
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INDEX

Operating Instructions Page 39	Hydraulic Control System Page 35
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GENERAL INFORMATION

Safety goggles should be worn at all times when working on transmissions.

The identification markings and usage of the Load-Flite Transmissions is charted in Diagnosis and Tests.

Because of the similarity in design and in servicing the transmissions, the procedures have been combined in this manual. Where variations in procedures occur, application is indicated (Fig. 1, 2 or 3).

Transmission operation requirements are different for each vehicle and engine combination and some internal parts will be different to provide for this. Therefore, when replacing parts, refer to the seven digit part number stamped on left side of the transmission oil pan flange.

All A-904T and A-999 transmissions are equipped with a wide-ratio gear set. Low gear ratio is 2.74 to 1. The sun gear and front planetary gear set is unique to the wide-ratio transmission. The rear planetary gear set remains the same as previous models.

The transmission combines a torque converter and a fully-automatic 3-speed gear system. The torque converter housing and transmission case are an integral aluminum casting. The transmission consists of 2 multiple-disc clutches, an overrunning clutch, 2 servos and bands, and 2 planetary gear sets to provide three forward ratios and a reverse ratio. The common sun gear of the planetary gear sets is connected to the front clutch by a driving shell which is splined to the sun gear and engages the front clutch retainer. The hydraulic system consists of an oil pump, and a single valve body assembly which contains all of the valves except the governor valve.

Venting of the transmission is accomplished by a passage through the upper part of the oil pump housing.

The torque converter is attached to the crankshaft through a flexible driving plate. Cooling of the torque converter is accomplished by circulating the transmission fluid through an oil-to-water type cooler, located

in the radiator lower tank. The torque converter assembly is a sealed unit which cannot be disassembled. A lockup clutch is located inside most torque converters.

The transmission fluid is filtered by an internal filter attached to the lower side of the valve body assembly.

Engine torque is transmitted to the torque converter, then, through the input shaft to the multiple-disc clutches in the transmission. The power flow depends on the application of the clutches and bands. Refer to "Elements in Use Chart" in Diagnosis and Tests section.

Lockup Torque Converter

The A-904T (except California models) and A-999 transmissions are both equipped with **lockup** torque converters. The A-727 transmission is **nonlockup**.

The lockup mode is activated only in direct drive and is controlled by the engine electronics. A lockup solenoid on the valve body transfer plate, is powered by the engine ESA module to activate torque converter lockup.

Lockup and nonlockup torque converters and transmissions are **not** intermixable.

HYDRAULIC CONTROL SYSTEM

The hydraulic control circuits diagrams show the position of the various valves with color coded passages to indicate those under hydraulic pressure for all operations of the transmission.

The hydraulic control system makes the transmission fully automatic, and has four important functions to perform. In a general way, the components of any automatic transmission control system may be grouped into the following basic groups:

The pressure supply system, the pressure regulating valves, the flow control valves, the clutches, and band servos.

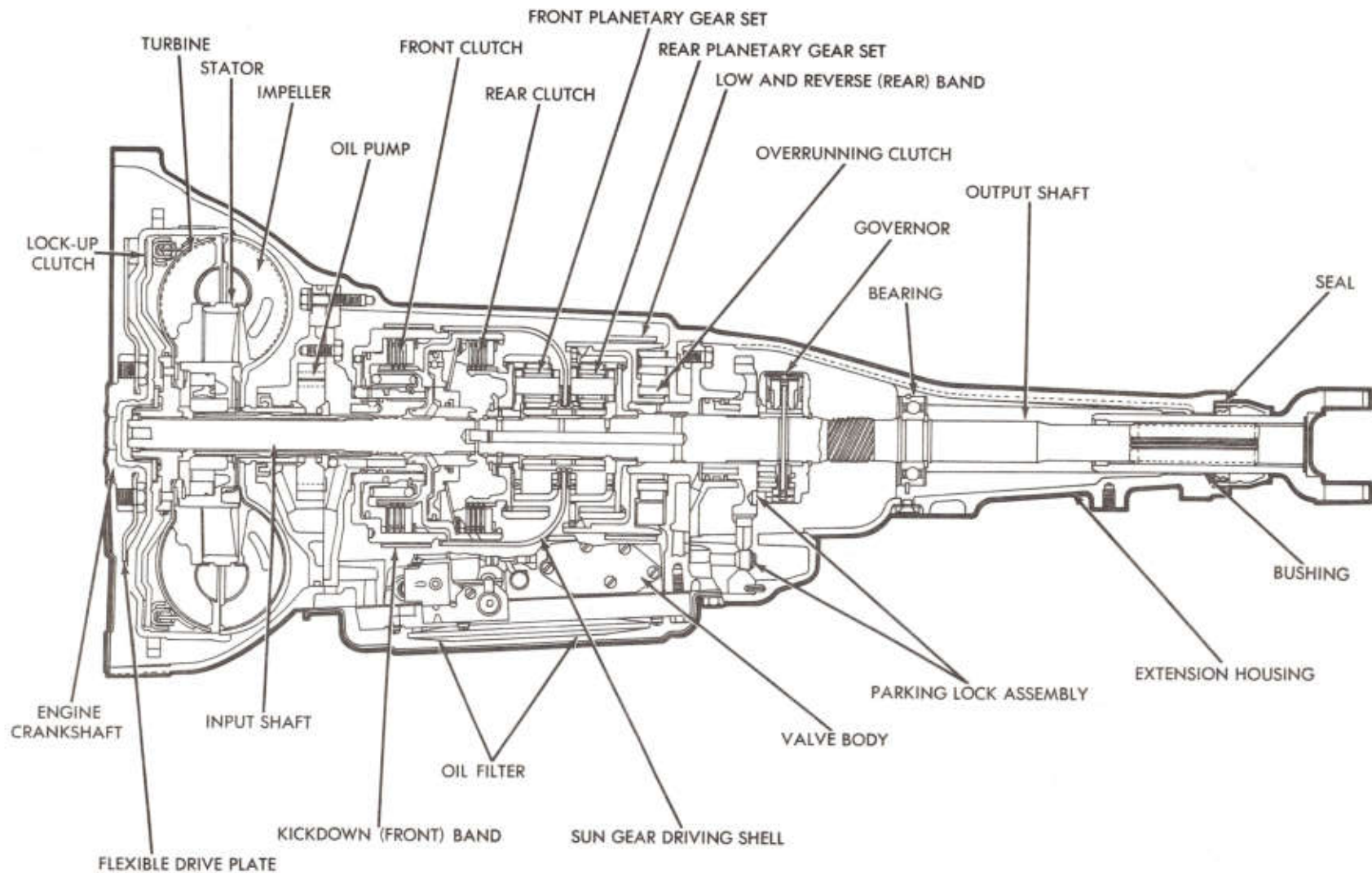


Fig. 1—LoadFlite Transmission and Torque Converter (A-904T and A-999)

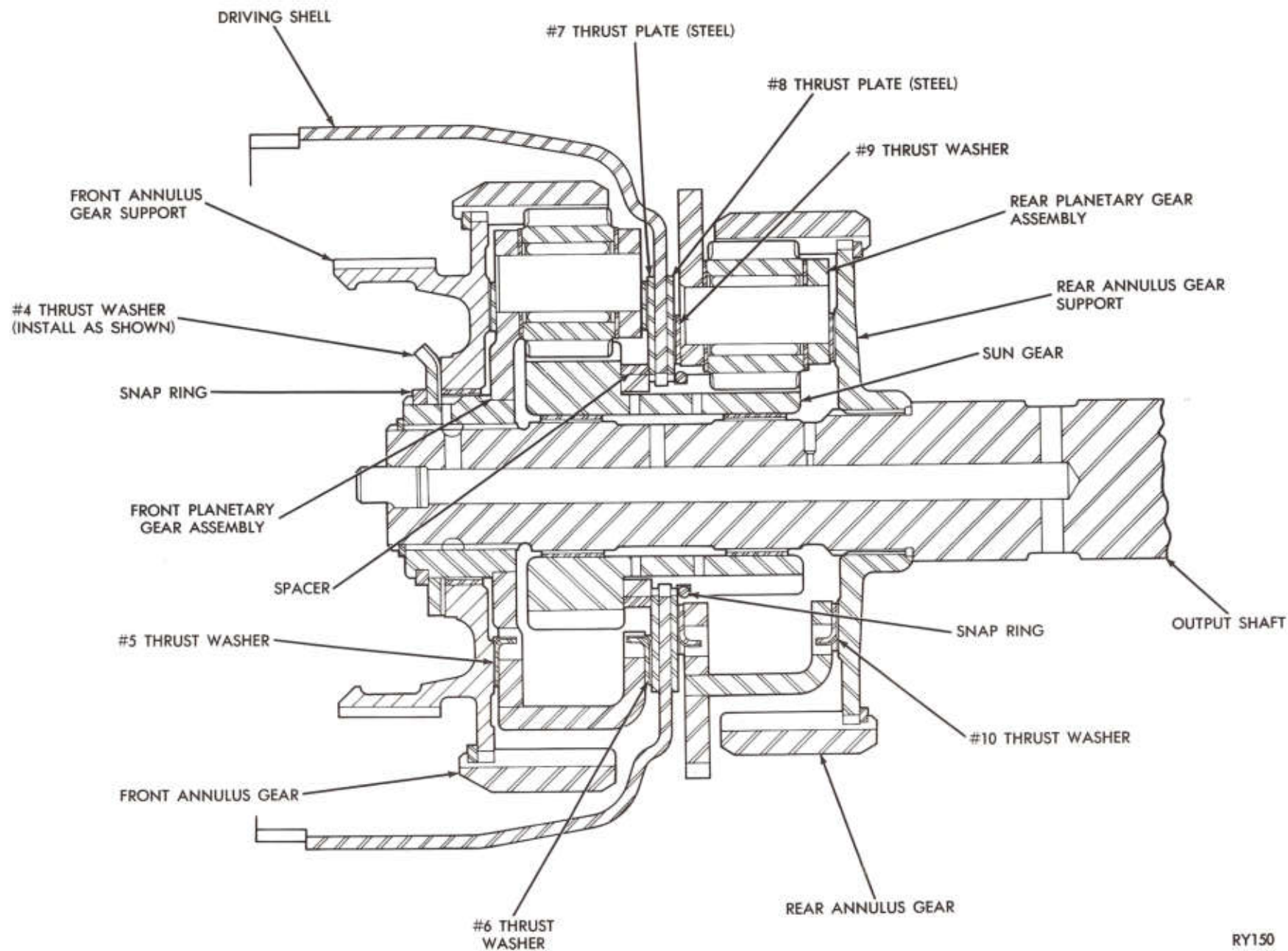


Fig. 2—Wide-Ratio Planetary Gears Assembly (A-904T and A-999)

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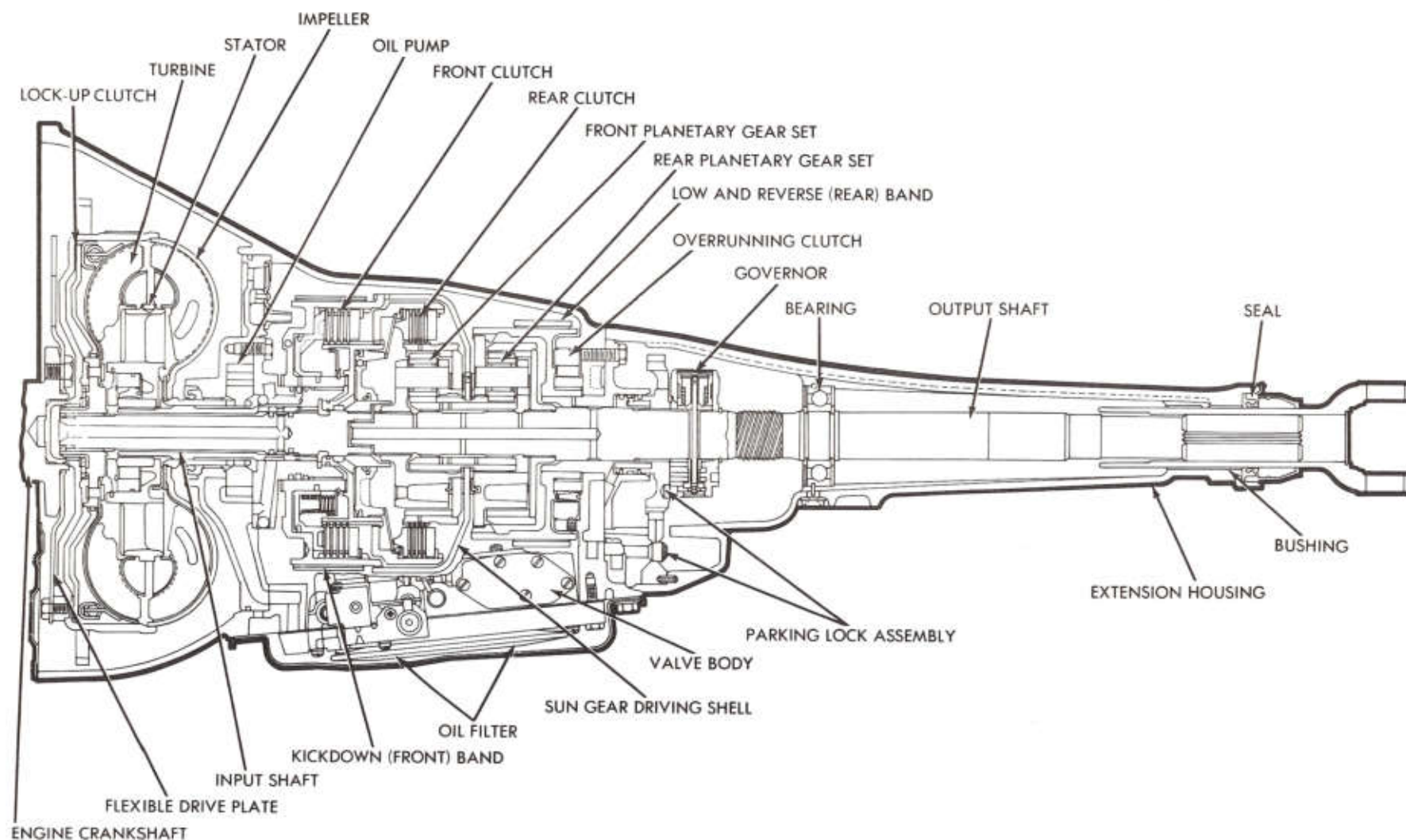


Fig. 3—LoadFlite Transmission and Torque Converter (A-727)

Taking each of these basic groups or systems in turn, the control system may be described as follows:

Pressure Supply System

The pressure supply system consists of an oil pump driven by the engine through the torque converter. The single front pump furnishes pressure for all the hydraulic and lubrication requirements.

Pressure Regulating Valves

The regulator valve controls line pressure dependent on throttle opening.

The governor valve controls governor pressure to the transmission (which varies with vehicle speed) to control upshift, downshift, and lockup speeds.

The throttle valve controls throttle pressure to the transmission (which varies with throttle position) to control upshift and downshift speeds.

Flow Control Valves

The manual valve provides the different transmission drive ranges as selected by the vehicle operator.

The 1-2 shift valve automatically shifts the transmission from low to second or from second to low depending on the vehicle operation.

The 2-3 shift valve automatically shifts the transmission from second to direct or from direct to second depending on the vehicle operation.

The kickdown valve makes possible a forced downshift from direct to second, second to breakaway, or direct to breakaway (depending on vehicle speed) by depressing the accelerator pedal past the detent "feel" near wide open throttle.

The throttle pressure plug at the end of the 2-3 shift valve, provides a 3-2 downshift with varying throttle openings depending upon vehicle speed.

The 1-2 shift control valve transmits 1-2 shift control pressure to the transmission accumulator piston to control the kickdown band capacity on 1-2 upshifts and 3-2 downshifts. The limit valve determines the maximum speed at which a 3-2 part throttle kickdown can be made. Some transmissions **do not** have the Limit Valve and the maximum speed for the 3-2 kickdown is at the "detent" position.

The shuttle valve has two separate functions and performs each independently of the other. The first is that of providing fast release of the kickdown band, and smooth front clutch engagement when the driver makes a "lift-foot" upshift from second to direct. The second function of the shuttle valve is to regulate the application of the kickdown servo and band when making direct to second kickdowns.

The lockup valve automatically applies the torque converter lockup clutch when fed with line pressure from the lockup solenoid. The lockup solenoid is controlled by the engine electronics through an electrical connector in the rear of the transmission case.

Electronic control of the torque converter lockup includes unlocking the torque converter at closed throttle, during engine warm-up, and during part-throttle acceleration. The nonlockup A-904T, used in California, has a threaded plug in the rear of the transmission case in place of the lockup wiring connector.

The fail-safe valve restricts feed to the lockup clutch if front clutch pressure drops. It permits lockup only in direct gear and provides a fast lockup release during a kickdown.

The switch valve directs oil to apply the lockup clutch in one position and releases it in the other as well as directs oil to the cooling and lube circuits. The switch valve also regulates the oil pressure to the torque converter and limits the maximum oil pressure to 130 psi.

Clutches, Band Servos, and Accumulator

The front and rear clutch pistons, and both servo pistons are moved hydraulically to engage the clutches and apply the bands. The pistons are released by spring tension when hydraulic pressure is released. On the 2-3 upshift, the kickdown servo piston is released by spring tension and hydraulic pressure and the lockup piston is applied by hydraulic pressure within the torque converter.

The accumulator controls the hydraulic pressure on the apply side of the kickdown servo during the 1-2 shift; thereby, cushioning the kickdown band application at any throttle position.

OPERATING INSTRUCTIONS

The transmission will automatically upshift and downshift at approximately the speeds shown in the "Automatic Shift Speed Chart." All shift speeds given in the "Chart" may vary somewhat due to production tolerances and rear axle ratios. The quality of the shifts is very important. All shifts should be smooth and positive with no noticeable engine runaway. See "Diagnosis and Tests" for chart.

Gearshift and Parking Lock Controls

The transmission is controlled by a "lever type" gearshift incorporated within the steering column. The control has six selector lever positions: P (park), R (reverse), N (neutral), D (drive), 2 (second), and 1 (first). The parking lock is applied by moving the selector lever past a gate to the P (park) position.

Do not apply the parking lock until the vehicle has stopped; otherwise, a severe ratcheting noise will occur.

Starting the Engine

The engine will start with the selector lever in either the P (park) or N (neutral) positions. As a safety

precaution when starting in the N (neutral) position, apply the parking or foot brake. The LoadFlite transmission will not permit starting the engine by pushing or towing.

Mountain Driving

When driving in the mountains with either heavy loads or when pulling trailers, the 2 (second) or 1 (low) position should be selected on upgrades which require heavy throttle for 1/2 mile or more. This reduces possibility of overheating the transmission and torque converter under these conditions.

Towing Vehicle

Transmission Inoperative: Tow the vehicle with a rear end pickup or remove the propeller shaft.

Transmission Operating Properly: The vehicle may be towed safely in N (neutral) with rear wheels on the ground at a speed not to exceed 30 mph (48 km/h). **If the vehicle is to be towed for extended distances, it should be done with a rear end pickup or the propeller shaft removed.** Because the transmission receives lubrication only when the engine is running, **it is good practice to always tow a disabled vehicle with a rear end pickup or remove the propeller shaft.**

DIAGNOSIS AND TESTS

INDEX

	Page
Clutch and Servo Air Pressure Tests	44
Torque Converter Stall Test	44
Diagnosis Charts	58
Diagnosis—General	40

	Page
Fluid Leakage	45
Hydraulic Pressure Tests	41
Oil Cooler and Cooler Tubes Flushing	40

DIAGNOSIS—GENERAL

Automatic transmission malfunctions may be caused by four general conditions: poor engine performance, improper adjustments, hydraulic malfunctions, and mechanical malfunctions. Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, manual linkage adjustment, and throttle linkage adjustment. Then perform a road test to determine whether the problem has been corrected or that more diagnosis is necessary. **If the problem exists after the preliminary tests and corrections are completed, hydraulic pressure tests should be performed.**

Fluid Level and Condition

If a failure of any kind has contaminated the transmission fluid, the oil cooler and cooler tubes must be reverse flushed (see "Oil Cooler and Cooler Tubes Flushing.")

Before removing the dipstick, wipe all dirt off of the protective cap and top of the filler tube.

Since the torque converter fills more slowly in the "P" Park position, place the selector lever in "N" Neutral to be sure that the fluid level check is accurate. **The vehicle must be on level ground.** The engine should be running at idle speed. The fluid should be at normal operating temperature (approximately 175° F). The fluid level is correct if it is between the "Full" and "Add" marks on the dipstick.

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transmission has too much fluid, the gears churn up foam and cause the same conditions which occur with a low fluid level.

In either case, the air bubbles can cause overheating, fluid oxidation, and varnishing, which can interfere with normal valve, clutch, and servo operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

Along with fluid level, it is important to check the condition of the fluid. When the fluid smells burned, and is contaminated with metal or friction material particles, a complete transmission overhaul is needed and because the torque converter cannot be flushed, it should be replaced. Be sure to examine the fluid on the dipstick closely. If there is any doubt about its condition, drain out a sample for a double check.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

OIL COOLERS AND TUBES FLUSHING

When a transmission or lockup clutch failure has contaminated the fluid, the oil cooler(s) should be reverse flushed to insure that metal particles or sludged oil are not later transferred back into the reconditioned transmission.

- (1) Disconnect both cooler lines at radiator.
- (2) Dislodge any foreign material at the inlet side of the cooler with a small screwdriver.
- (3) Reverse flush the cooler with a combination of mineral spirits and pulsating air under pressure (shop air).
- (4) Treat the cooler lines separately and insure they

are clear by flowing mineral spirits or automatic transmission fluid through them.

(5) Remove leftover mineral spirits from cooler and cooler lines by flowing automatic transmission fluid through them.

(6) Cooler flow should now be checked by connecting the cooler tubes and placing the rear cooler tube into a 1 quart container. Overfill the transmission by 1 quart. Watching a clock, start engine (run at curb idle) and run in neutral for exactly 20 seconds. If cooler flow is less than 1 quart in 20 seconds, replace the radiator or have the radiator bottom cooler professionally reconditioned.

Manual Linkage

Normal operation of the neutral safety switch provides a quick check to confirm proper manual linkage adjustment.

Move the selector lever slowly upward until it clicks into the "P" Park notch in the selector gate. If the starter will operate the "P" position is correct.

After checking "P" position move the selector slowly toward "N" Neutral position until the lever drops at the end of the "N" stop in the selector gate. If the starter will also operate at this point the manual linkage is properly adjusted. If adjustment is required, refer to "Gearshift Linkage Adjustment" in "Maintenance and Adjustments".

Throttle Linkage

The throttle rod adjustment is very important to proper transmission operation. This adjustment positions a valve which controls shift speed, shift quality and part throttle downshift sensitivity. If the setting is too short, early shifts and slippage between shifts may occur. If the setting is too long, shifts may be delayed and part throttle downshifts may be very sensitive. Refer to "Throttle Rod Adjustment" in "Maintenance and Adjustments".

Road Test

Prior to performing a road test, be certain that the fluid level and condition, and control linkage adjustments have been checked and approved.

During the road test the transmission should be operated in each position to check for slipping and any variation in shifting. Note whether the shifts are harsh or spongy and check the speeds where the upshifts and downshifts occur. Approximate shift speeds for the various modes of operation are shown in the "Automatic Shift Speeds and Governor Pressure" chart.

Observe closely for slipping or engine speed flare-up. Slipping or flare-up in any gear usually indicates clutch, band, or overrunning clutch problems. If the condition is far advanced, an overhaul will probably

be necessary to restore normal operation.

In most cases, the clutch or band that is slipping can be determined by noting the transmission operation in all selector positions and by comparing which internal units are applied in those positions. The "Elements in Use Chart" provides a basis for road test analysis.

By observing that the rear clutch is applied in both the "D" first gear and "1" first gear positions, but that the overrunning clutch is applied in "D" first and the low and reverse band is applied in "1" first, if the transmission slips in "D" range first gear but does not slip in "1" first gear, the overrunning clutch must be the unit that is slipping. Similarly, if the transmission slips in any two forward gears, the rear clutch is the slipping unit.

Using the same procedure, the rear clutch and front clutch are applied in "D" third gear. If the transmission slips in third gear, either the front clutch or the rear clutch is slipping. By selecting another gear which does not use one of those units, the unit which is slipping can be determined. If the transmission also slips in reverse, the front clutch is slipping. If the transmission does not slip in reverse, the rear clutch is slipping.

This process of elimination can be used to detect any unit which slips and to confirm proper operation of good units. However, although road test analysis can usually diagnose slipping units, the actual cause of the malfunction usually cannot be decided. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Therefore, unless the condition is obvious, like no drive in "D" range first gear only, the transmission should never be disassembled until hydraulic pressure tests have been performed.

HYDRAULIC PRESSURE TESTS

Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most transmission problems.

Before performing pressure tests, be certain that fluid level and condition, and control linkage adjustments have been checked and approved. Fluid must be at operating temperature (150 to 200 degrees F.).

Install an engine tachometer, raise vehicle on hoist which allows rear wheels to turn, and position the tachometer so it can be read under the vehicle.

Disconnect throttle rod and shift rod from transmission levers so they can be controlled under the vehicle.

Attach 100 psi gauges (C-3292) to ports required for test being conducted. A 300 psi gauge (C-3293) is required for "reverse" pressure test at rear servo.

Test port locations are shown in (Figs. 1 and 2).

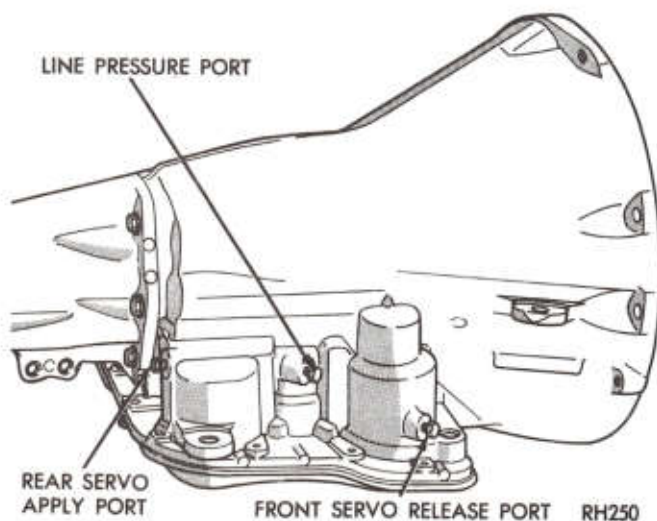


Fig. 1—Pressure Test Locations

Test One (Selector in "1")

- (1) Attach gauges to "line" and "rear servo" ports.
- (2) Operate engine at 1000 rpm for tests.
- (3) Move selector lever on transmission all the way forward ("1" position).
- (4) Read pressures on both gauges as throttle lever on transmission is moved from full forward position to full rearward position.
- (5) Line pressure should read 54 to 60 psi (372 to 414 kPa) with throttle lever forward and gradually increase, as lever is moved rearward, to 90 to 96 psi (621 to 662 kPa).
- (6) Rear servo pressure should read the same as line pressure within 3 psi.
- (7) This tests pump output, pressure regulation, and condition of rear clutch and rear servo hydraulic circuits.

Test Two (Selector in "2")

- (1) Attach gauge to "line pressure" port and "tee" into rear cooler line fitting to read "lubrication" pressure.

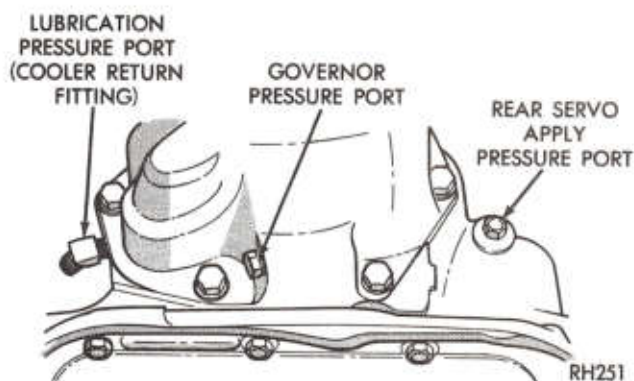


Fig. 2—Pressure Test Locations

- (2) Operate engine at 1000 rpm for test.
- (3) Move the selector lever on transmission one "detent" rearward from full forward position. This is selector "2" position.
- (4) Read pressures on both gauges as throttle lever on transmission is moved from full forward position to full rearward position.
- (5) Line pressure should read 54 to 60 psi (372 to 414 kPa) with throttle lever forward and gradually increase, as lever is moved rearward, to 90 to 96 psi (621 to 662 kPa).
- (6) Lubrication pressure should be 5 to 15 psi (34 to 103 kPa) with lever forward and 10 to 30 psi (68 to 204 kPa) with lever rearward.
- (7) This tests pump output, pressure regulation, and condition of rear clutch and lubrication hydraulic circuits.

Test Three (Selector in "D")

- (1) Attach gauges to "line" and "front servo release" ports.
- (2) Operate engine at 1600 rpm for test.
- (3) Move the selector lever on transmission two "detents" rearward from full forward position. This is selector "D" position.
- (4) Read pressures on both gauges as throttle lever

ELEMENTS IN USE AT EACH POSITION OF THE SELECTOR LEVER

Lever Position	Standard Ratio	Wide Ratio	Start Safety	Parking Sprag	Clutches				Bands	
					Front	Rear	Over-running	Lockup	(Kickdown) Front	(Low-Rev.) Rear
P—PARK			X	X						
R—REVERSE	2.21	2.21			X					X
N—NEUTRAL			X							
D—DRIVE										
First	2.45	2.74				X	X			
Second	1.45	1.54				X			X	
Direct	1.00	1.00			X	X		X		
2—SECOND										
First	2.45	2.74				X	X			
Second	1.45	1.54				X			X	
1—LOW (First)	2.45	2.74				X				X

on transmission is moved from full forward position to full rearward position.

(5) Line pressure should read 54 to 60 psi (372 to 414 kPa) with throttle lever forward and gradually increase, as lever is moved rearward.

(6) Front servo release is pressurized only in direct drive and should be same as line pressure within 3 psi (21 kPa), up to downshift point.

(7) This tests pump output, pressure regulation, and condition of rear clutch, front clutch, and lockup clutch hydraulic circuits.

Test Four (Selector in Reverse)

(1) Attach 300 psi gauge to "rear servo apply" port.

(2) Operate engine at 1600 rpm for test.

(3) Move the selector lever on transmission four "detents" rearward from full forward position. This is selector "R" position.

(4) Rear servo pressure should read 145 to 175 psi with throttle lever forward and increase gradually to 230-280 psi as throttle lever is moved rearward.

(5) This tests pump output, pressure regulation, and condition of front clutch and rear servo hydraulic circuits.

(6) Move selector lever on transmission to "D" position to check that rear servo pressure drops to zero.

(7) This tests for leakage into rear servo, due to case porosity, which can cause reverse band burn out.

Test Result Indications

(1) If proper line pressure, minimum to maximum, is found in any one test, the pump and pressure regulator are working properly.

(2) Low pressure in "D, 1 and 2" but correct pressure in "R" indicates rear clutch circuit leakage.

(3) Low pressure in "D and R" but correct pressure in "1" indicates front clutch circuit leakage.

(4) Low pressure in "R and 1" but correct pressure in "2" indicates rear servo circuit leakage.

(5) Low line pressure in all positions indicates a defective pump, a clogged transmission oil filter, or a stuck pressure regulator valve.

Governor Pressure

Test only if transmission shifts at wrong vehicle speeds when throttle rod is correctly adjusted.

(1) Connect a 0-100 psi pressure gauge, to governor pressure take-off point, located at lower left side of

AUTOMATIC SHIFT SPEEDS AND GOVERNOR PRESSURE CHART

(APPROXIMATE MILES PER HOUR AT ROAD LOAD)
(km/h = kilometers per hour)

Engine (Liter)	3.9L				5.2L/5.9L			
Model	150	250	150	150	250	350		
Axle Ratio	3.21	3.54	2.71	2.94	3.21	3.54		
Tire Size	P195/75R15	P235/75R15XL	P195/75R15	P195/75R15	P235/75R15XL	8.75x16.5-E		
Throttle Closed	mph km/h	mph km/h	mph km/h	mph km/h	mph km/h	mph km/h	mph km/h	mph km/h
1-2 Upshift	8-10 13-16	8-10 13-16	10-12 16-19	9-11 14-19	9-11 14-19	8-11 13-18		
2-3 Upshift	11-14 18-23	11-14 18-23	13-17 21-27	12-15 19-24	12-16 19-26	12-16 19-26		
3-1 Downshift .	8-10 13-16	8-10 13-16	10-12 16-19	9-11 14-19	9-11 14-19	8-11 13-18		
Throttle Wide Open								
1-2 Upshift	29-36 46-57	29-36 46-57	34-42 55-68	31-39 50-63	36-43 58-69	34-41 55-66		
2-3 Upshift	55-61 89-98	55-61 89-98	65-73 105-118	60-67 97-108	63-70 101-113	60-67 97-108		
Kickdown Range								
3-2 Downshift	50-57 80-92	50-57 80-92	60-68 97-109	55-63 89-101	58-65 93-101	55-62 89-100		
3-1 Downshift	25-27 40-43	25-27 40-43	30-32 48-52	28-30 45-48	27-35 43-56	26-33 42-53		
Governor Pressure*								
15 psi	16-18 26-29	16-18 26-29	19-21 31-34	17-19 27-31	17-20 27-32	16-19 26-31		
50 psi	36-41 58-66	36-41 58-66	43-49 69-79	40-45 64-72	43-49 69-79	41-47 66-76		
75 psi	54-59 87-95	54-59 87-95	64-70 103-113	59-65 95-105	62-68 100-110	59-65 95-105		

*Governor pressure should be from zero to 1.5 psi at standstill or downshift may not occur.

NOTE: Figures given are typical for the axle ratio and tire size combination. Changes in tire size or axle ratio will cause shift points occur at correspondingly higher or lower vehicle speeds.

extension near the mounting flange (Fig. 2).

(2) Operate transmission in third gear to read pressures and compare speeds shown in chart.

If governor pressures are incorrect at the given vehicle speeds, the governor valve and/or weights are probably sticking. The governor pressure should respond smoothly to changes in mph and should return to 0 to 1-1/2 psi (10 kPa) when vehicle is stopped. High pressure (above 2 psi) when vehicle is stopped will prevent the transmission from downshifting.

Throttle Pressure

No gauge port is provided for throttle pressure. Incorrect throttle pressure should only be suspected if part throttle upshift speeds are either delayed or occur too early in relation to vehicle speeds. Engine runaway on either upshifts or downshifts can also be an indicator of incorrect (low) throttle pressure setting.

In no case should throttle pressure be adjusted until the transmission throttle linkage adjustment has been verified to be correct.

TORQUE CONVERTER STALL TEST

WARNING: DO NOT LET ANYONE STAND IN FRONT OF VEHICLE DURING TEST.

The stall test consists of determining the engine speed obtained at full throttle in D position only. This test checks the torque converter stator clutch operation, and the holding ability of the transmission clutches. The transmission oil level should be checked and the engine brought to normal operating temperature before stall operation. **Both the parking and service brakes must be fully applied and front wheels blocked while making this test.**

Do not hold the throttle open any longer than is necessary to obtain a maximum engine speed reading, and never longer than five seconds at a time. If more than one stall check is required, operate the engine at approximately 1,000 rpm in neutral for 20 seconds to cool the transmission fluid between runs. If engine speed exceeds the maximum limits shown, release the accelerator immediately since transmission clutch slippage is indicated.

Stall Speed Above Specification

If stall speed exceeds the maximum specified in

chart by more than 200 rpm, transmission clutch slippage is indicated. Follow the transmission oil pressure and air pressure checks outlined in this section to determine the cause of slippage.

Stall Speed Below Specification

Low stall speeds, with a properly tuned engine, indicate torque converter stator clutch problems. A road test will be necessary to identify the exact problem.

If stall speeds are 250-350 rpm below specification, and the vehicle operates properly at highway speeds, but has poor through-gear acceleration, the stator overrunning clutch is slipping (lockup and nonlockup torque converters).

If stall speed and acceleration are normal, but abnormally high throttle opening is required to maintain highway speeds, the stator clutch has seized (nonlockup torque converter only).

Both of these stator defects require replacement of the torque converter.

Noise

A whining or siren-like noise due to fluid flow is normal during stall operation with some torque converters; however, loud metallic noises from loose parts or interference within the assembly indicate a defective torque converter. To confirm that the noise originates within the torque converter, operate the vehicle at light throttle in "D" and "N" on a hoist and listen under the transmission bell housing.

CLUTCH AND SERVO AIR PRESSURE TESTS

A "No Drive" condition might exist even with correct fluid pressure, because of inoperative clutches or bands. The inoperative units, clutches, bands, and servos can be located through a series of tests by substituting air pressure for fluid pressure (Fig. 3).

The front and rear clutches, kickdown servo, and low-reverse servo may be tested by applying air pressure to their respective passages after the valve body assembly has been removed. To make air pressure tests, proceed as follows:

Compressed-air supply must be free of all dirt or moisture. Use a pressure of 30 psi.

LOADFLITE TRANSMISSION STALL SPEED CHART

Engine (Liter)	Torque Converter Diameter	Engine Stall Speed rpm
3.9L	10-3/4 inch	1800-2100
5.2L	10-3/4 inch	1700-2000
5.9L	10-3/4 inch	1700-2000

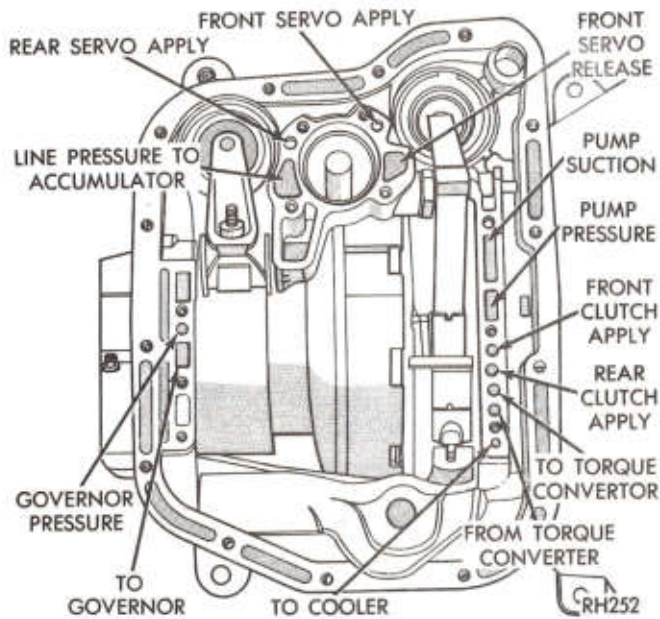


Fig. 3—Air Pressure Tests

Front Clutch

Apply air pressure to front clutch "apply" passage and listen for a dull "thud" which indicates that front clutch is operating. Hold air pressure on for a few seconds and inspect system for excessive oil leaks.

Rear Clutch

Apply air pressure to rear clutch "apply" passage and listen for a dull "thud" which indicates that rear clutch is operating. Also inspect for excessive oil leaks. If a dull "thud" cannot be heard in the clutches, place finger tips on clutch housing and again apply air pressure. Movement of piston can be felt as the clutch is applied.

Kickdown Servo (Front)

Direct air pressure into front servo "apply" passage. Operation of servo is indicated by a tightening of front band. Spring tension on servo piston should release the band.

Low - Reverse Servo (Rear)

Direct air pressure into rear servo "apply" passage. Operation of servo is indicated by a tightening of rear band. Spring tension on servo piston should release the band.

If clutches and servos operate properly, no upshift or erratic shift conditions indicate that malfunctions exist in the valve body.

FLUID LEAKAGE—TRANSMISSION TORQUE CONVERTER HOUSING AREA

- (1) Check for Source of Leakage.

Since fluid leakage at or around the torque converter area may originate from an engine oil leak, the area should be examined closely. Factory fill fluid is dyed red and, therefore, can be distinguished from engine oil.

- (2) Prior to removing the transmission, perform the following checks:

When leakage is determined to originate from the transmission, check fluid level prior to removal of the transmission and torque converter.

High oil level can result in oil leakage out the vent located at the top of the front pump housing. If the fluid level is high, adjust to proper level.

After performing this operation, inspect for leakage. If a leak persists, perform the following operation on the vehicle to determine whether it is the torque converter or transmission that is leaking.

Leakage Test Probe

- (1) Remove torque converter housing dust shield.
- (2) Position vehicle with front lower than back so that accumulated fluid in torque converter housing will drain out. Wipe inside of torque converter housing as dry as possible. A solvent spray followed by compressed-air drying is recommended.

- (3) Fabricate and fasten test probe (Fig. 4) securely to convenient dust shield bolt hole. Make certain torque converter is cleared by test probe. Tool must be clean and dry.

- (4) Run engine at approximately 2,500 rpm with transmission in neutral, for about 2 minutes. Transmission must be at operating temperature.

- (5) Stop engine and carefully remove tool.

- (6) If upper surface of test probe is dry, there is no torque converter leak. A path of fluid across probe indicates a torque converter leak. Oil leaking under the probe is coming from the transmission pump housing area (Fig. 5).

- (7) Remove the transmission and torque converter assembly from vehicle for further investigation. The fluid should be drained from the transmission. Reinstall oil pan (with new gasket) at specified torque.

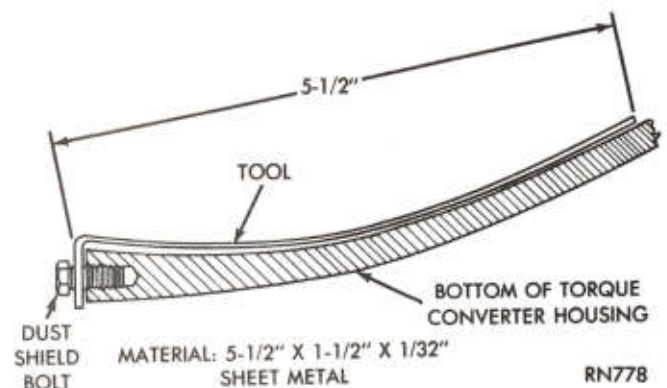


Fig. 4—Leak Locating Test Probe Tool

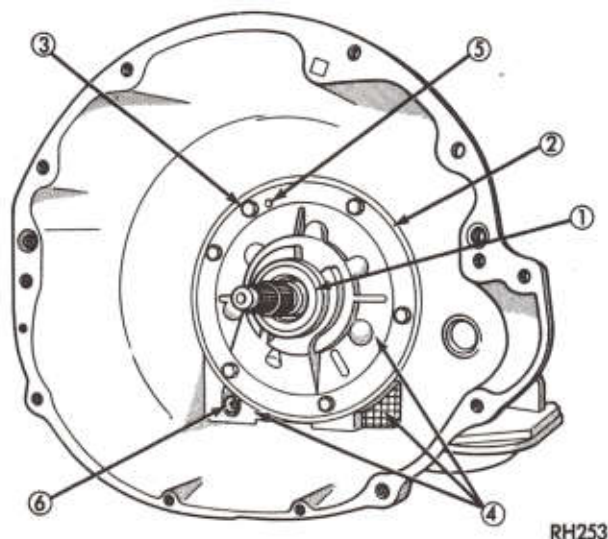


Fig. 5—Pump Housing Area

Possible sources of transmission pump housing area fluid leakage shown in (Fig. 5) are:

- (1) Torque converter hub seal.
 - (a) Seal lip cut; check torque converter hub finish.
 - (b) Bushing moved and/or worn.
 - (c) Oil return hole in front pump housing plugged or omitted.
 - (d) Seal worn out (high-mileage vehicles).
- (2) Fluid leakage at the outside diameter from pump housing O-ring seal.
- (3) Fluid leakage at the front pump to case bolts.
- (4) Fluid leakage due to case or front pump housing porosity.
- (5) Oil leakage out the vent.
- (6) Kickdown lever shaft access plug.

Torque Converter Leakage (Fig. 6)

Possible sources of torque converter leakage are:

- (a) Torque converter weld leaks at the outside diameter (peripheral) weld.

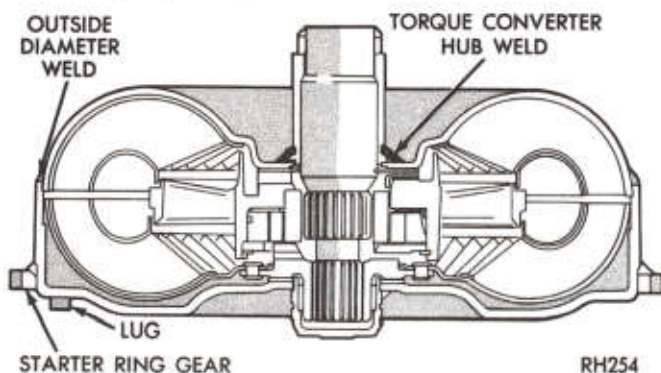


Fig. 6—Torque Converter (Nonlockup)

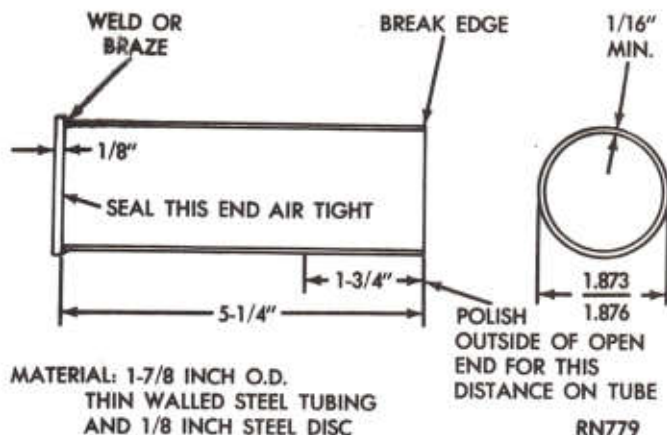


Fig. 7—A-727 Hub Seal Cup

- (b) Torque converter hub weld.

Air Pressure Test of Transmission

Fabricate equipment needed for test as shown in (Figs. 7 through 11).

The transmission should be prepared for pressure test as follows after removal of the torque converter:

- (1) Install filler tube bore plug, propeller shaft yoke (tie in with cord or wire), flared tube fitting cap (on

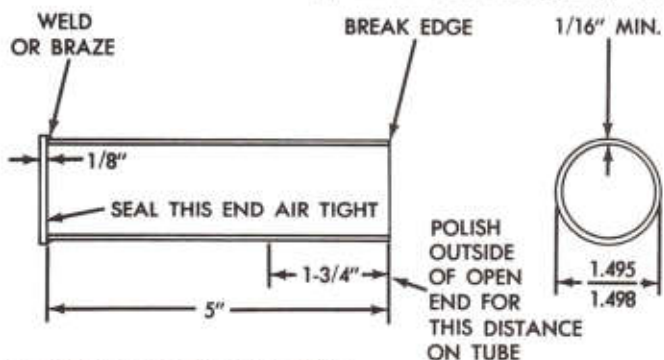


Fig. 8—A-904T and A-999 Hub Seal Cup

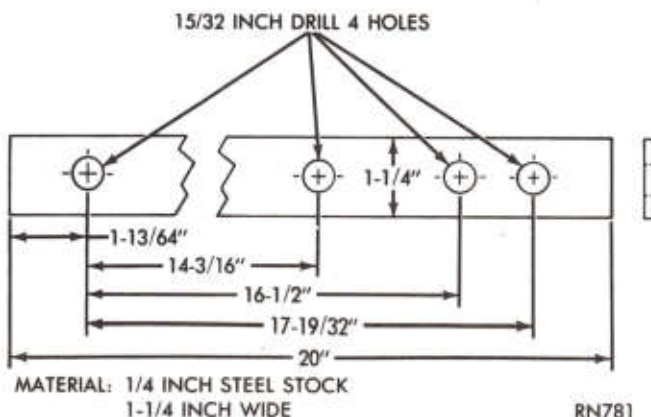


Fig. 9—Hub Seal Cup Retaining Strap

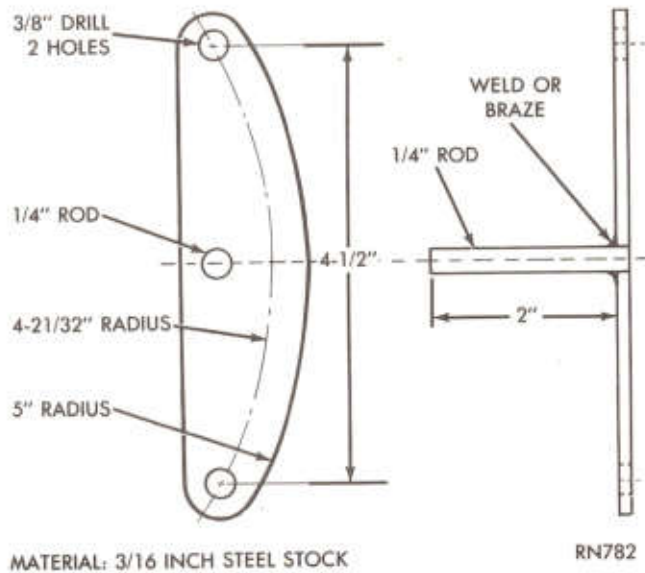


Fig. 10—A-727 Vent Plug Retainer

front cooler line fitting), and a short piece of tubing, flared at one end, on the rear cooler line fitting (Figs. 12 and 13).

(2) Remove necessary front pump housing bolts. Install vent plug (rubber stopper), and vent plug retainer preferably using longer bolts than those removed.

(3) With rotary motion, install torque converter hub seal cup over input shaft, and through the torque converter hub seal until the cup bottoms against the

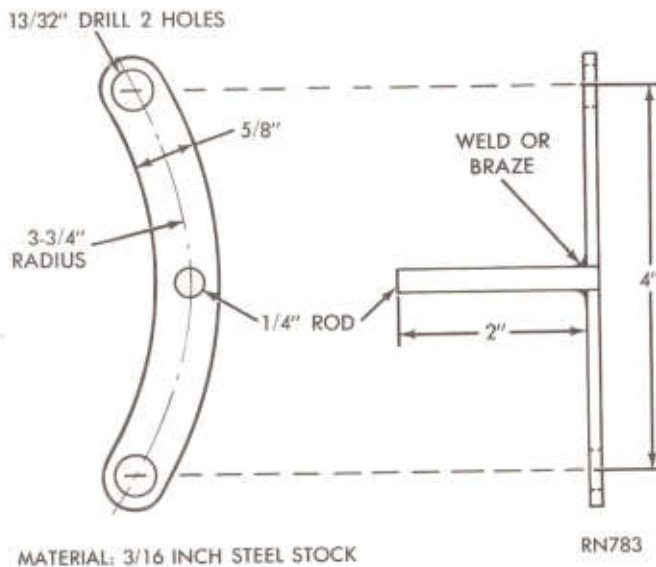


Fig. 11—A-904T and A-999 Vent Plug Retainer

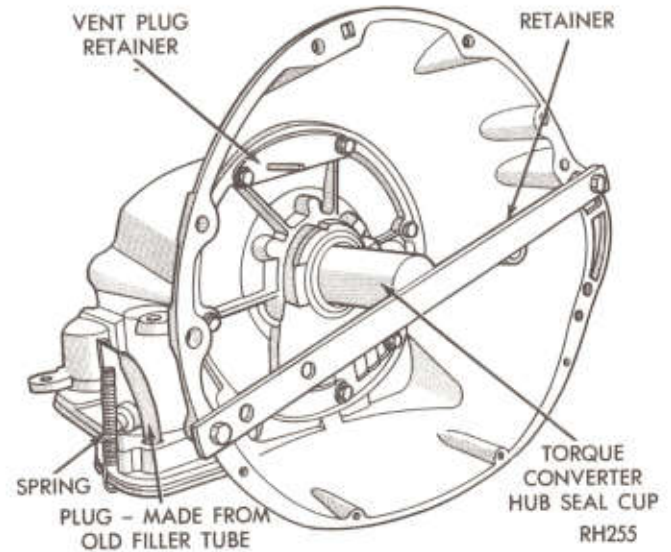


Fig. 12—Transmission Prepared for Test

pump gear lugs. Secure with cup retainer strap (Fig. 9), using torque converter housing to engine block retaining bolts.

(4) Attach and clamp hose from nozzle of Tool C-4080 to tubing which is on the rear cooler line fitting (Fig. 13).

(5) Pressurize the transmission using Tool C-4080 until the pressure gauge reads 8 psi. Position transmission so that pump housing and case front may be covered with soapy solution or water. Leaks are sometimes caused by porosity in the case or pump housing. **CAUTION: Do not, under any circumstances, pressurize a transmission to more than 10 psi.**

If a leak source is located, that part and all associated seals and gaskets should be replaced with new parts.

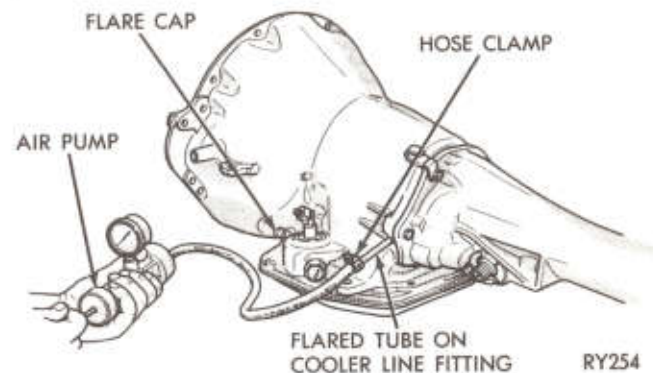
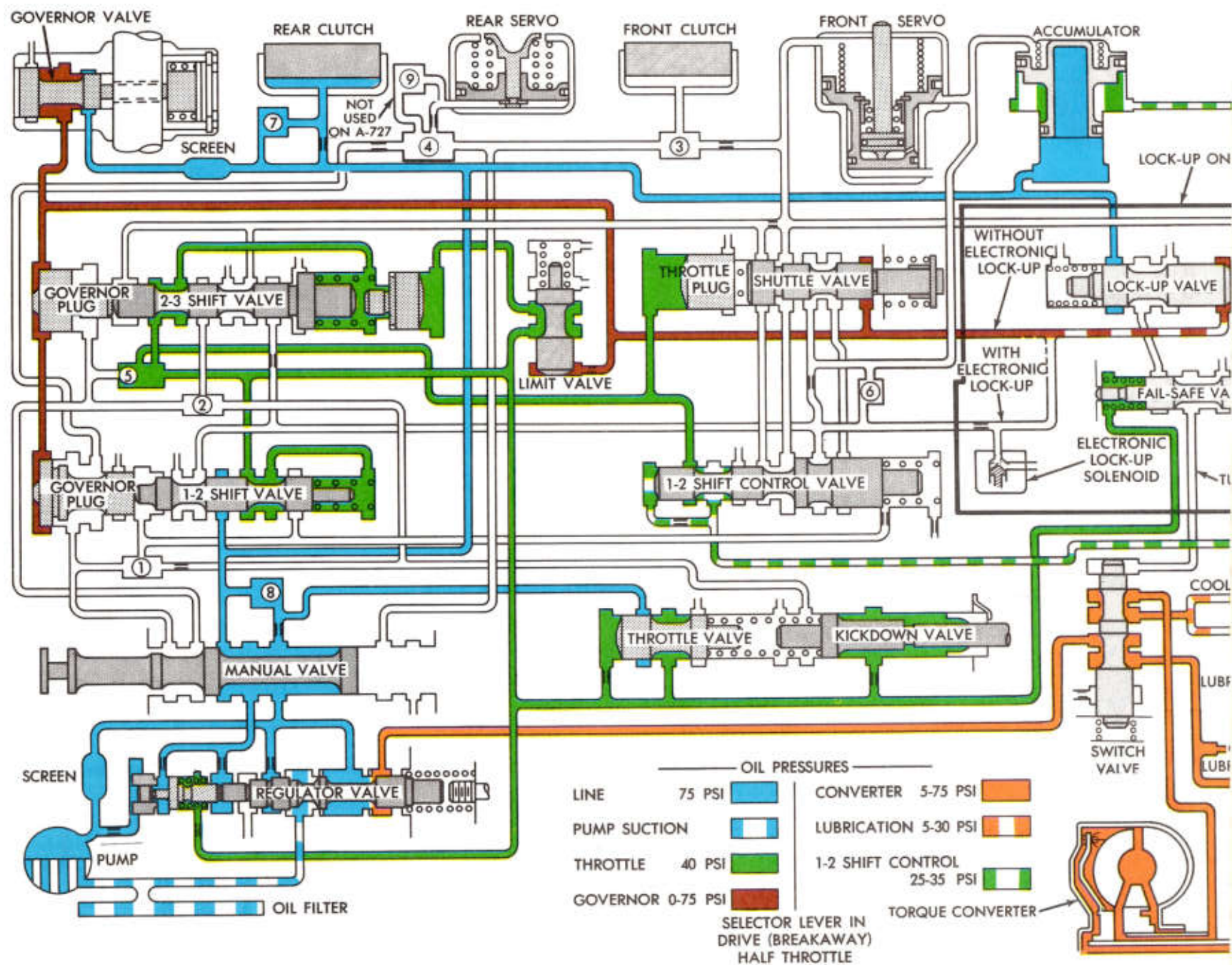
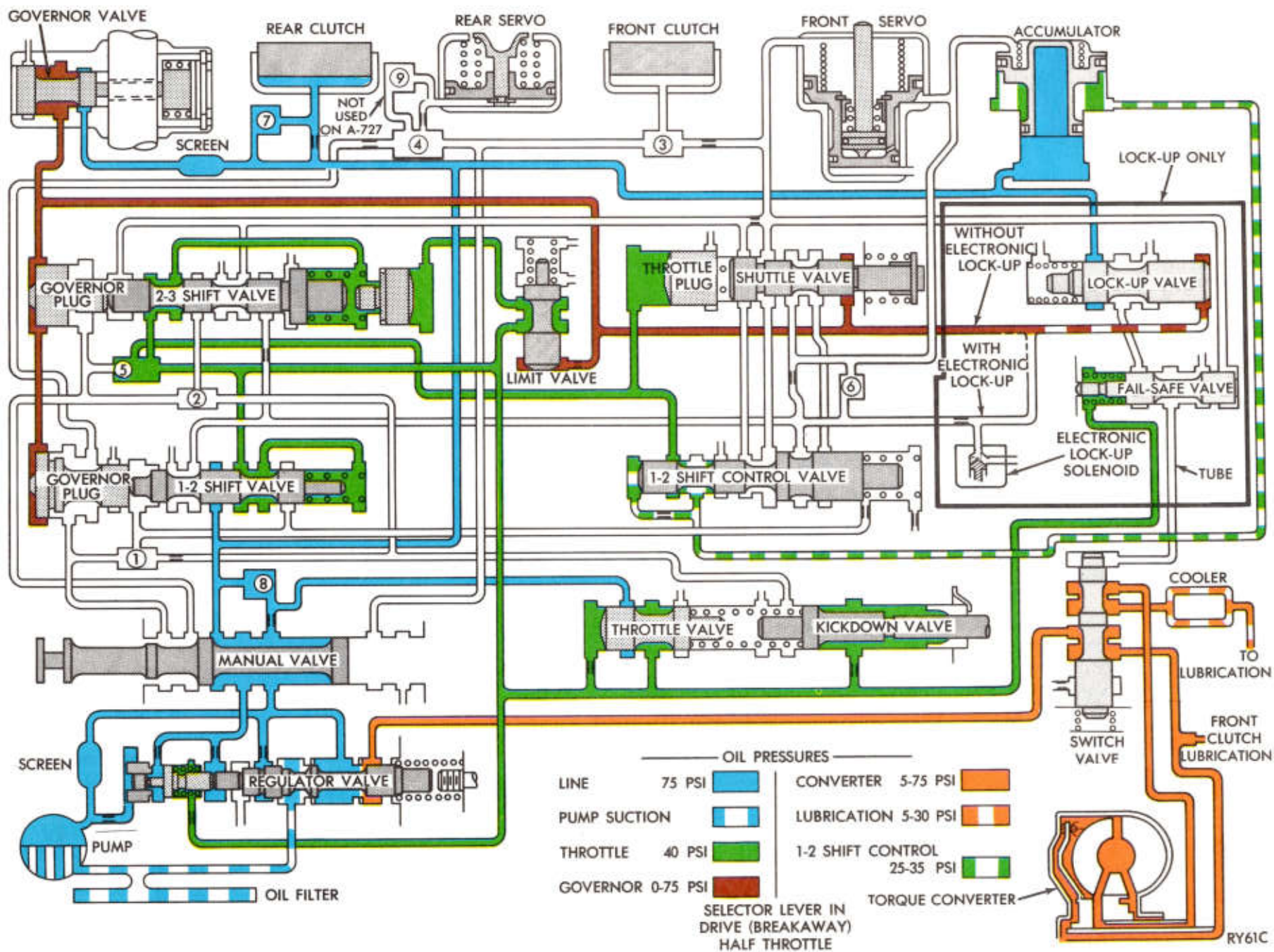
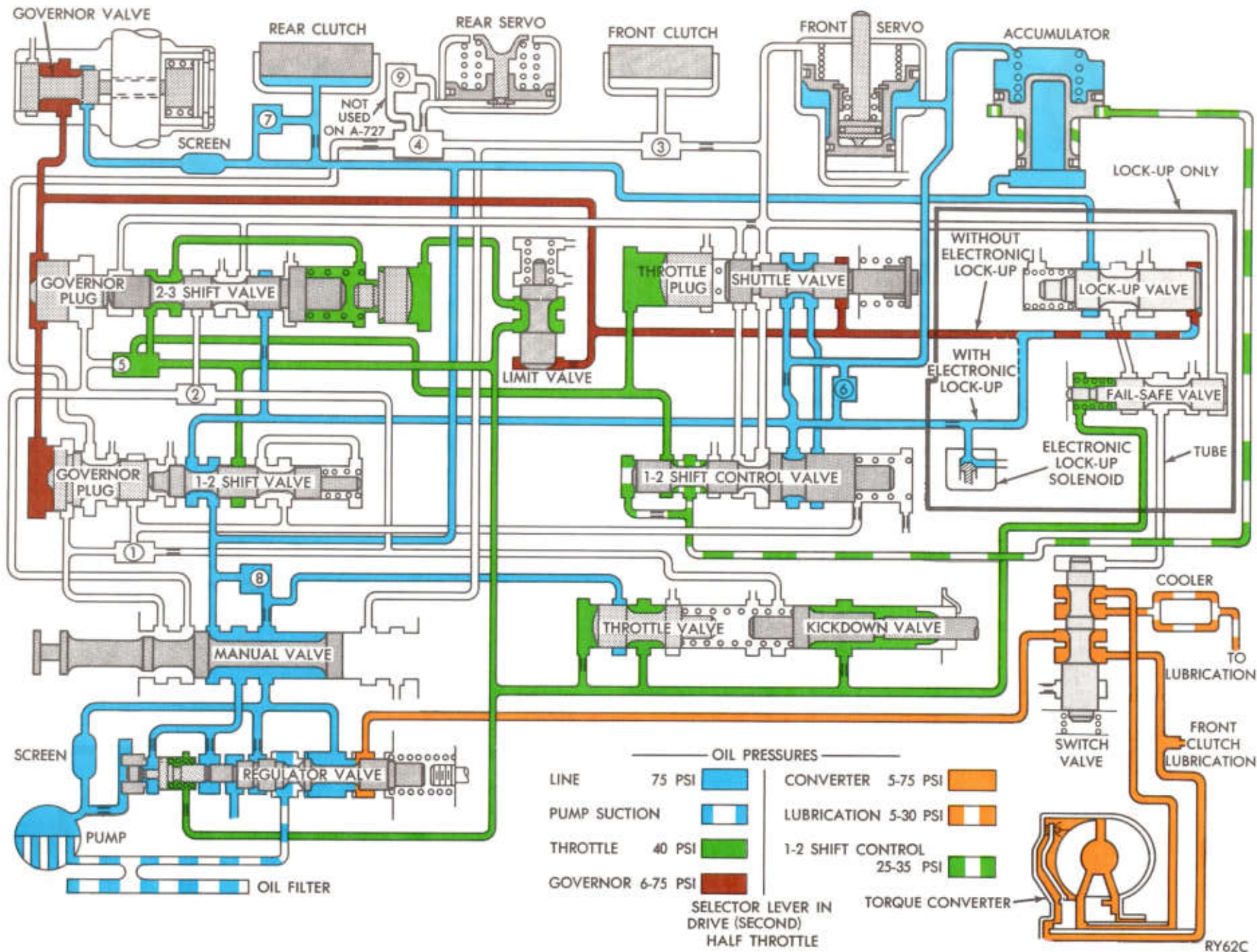


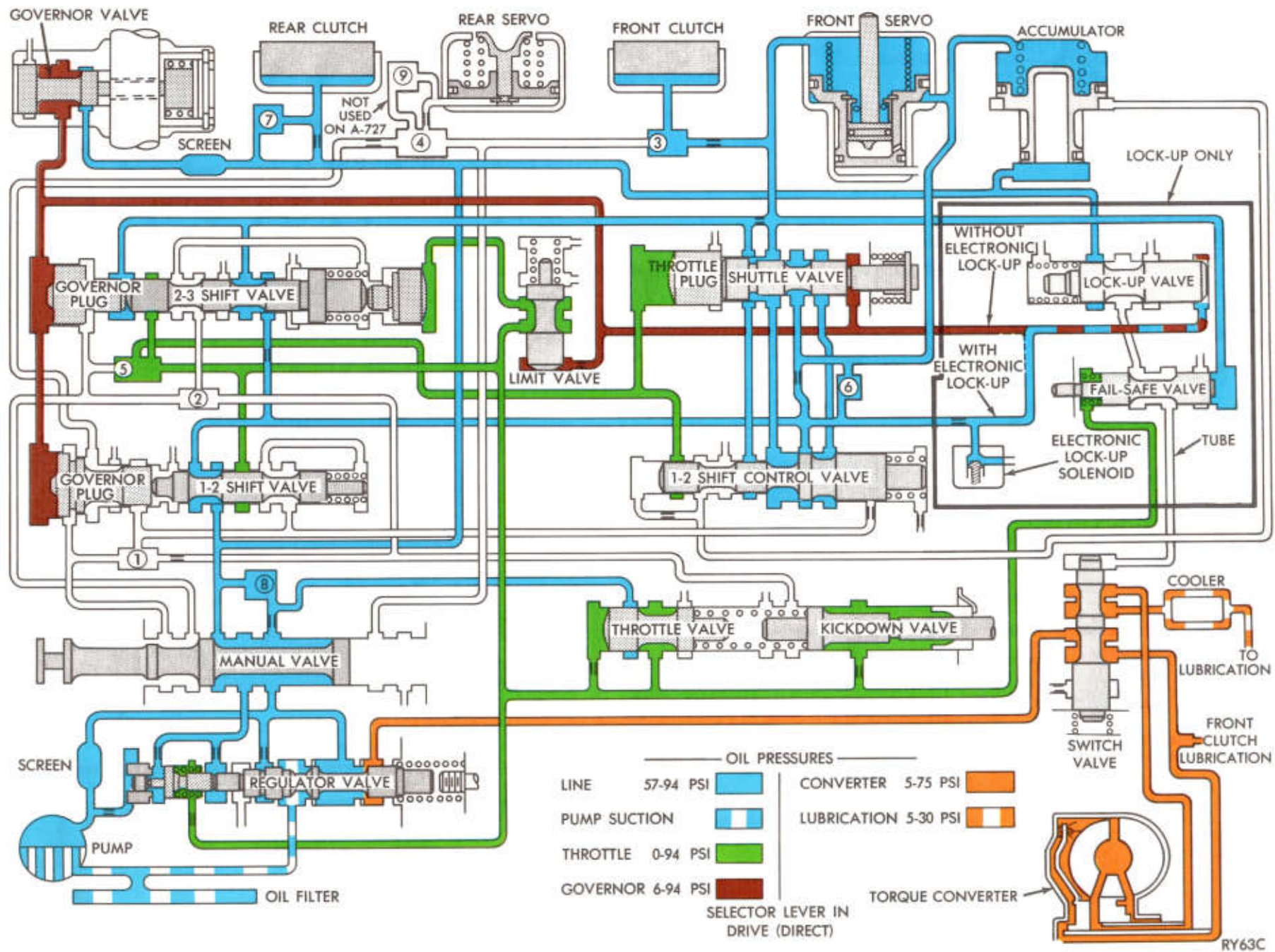
Fig. 13—Pressurizing Transmission

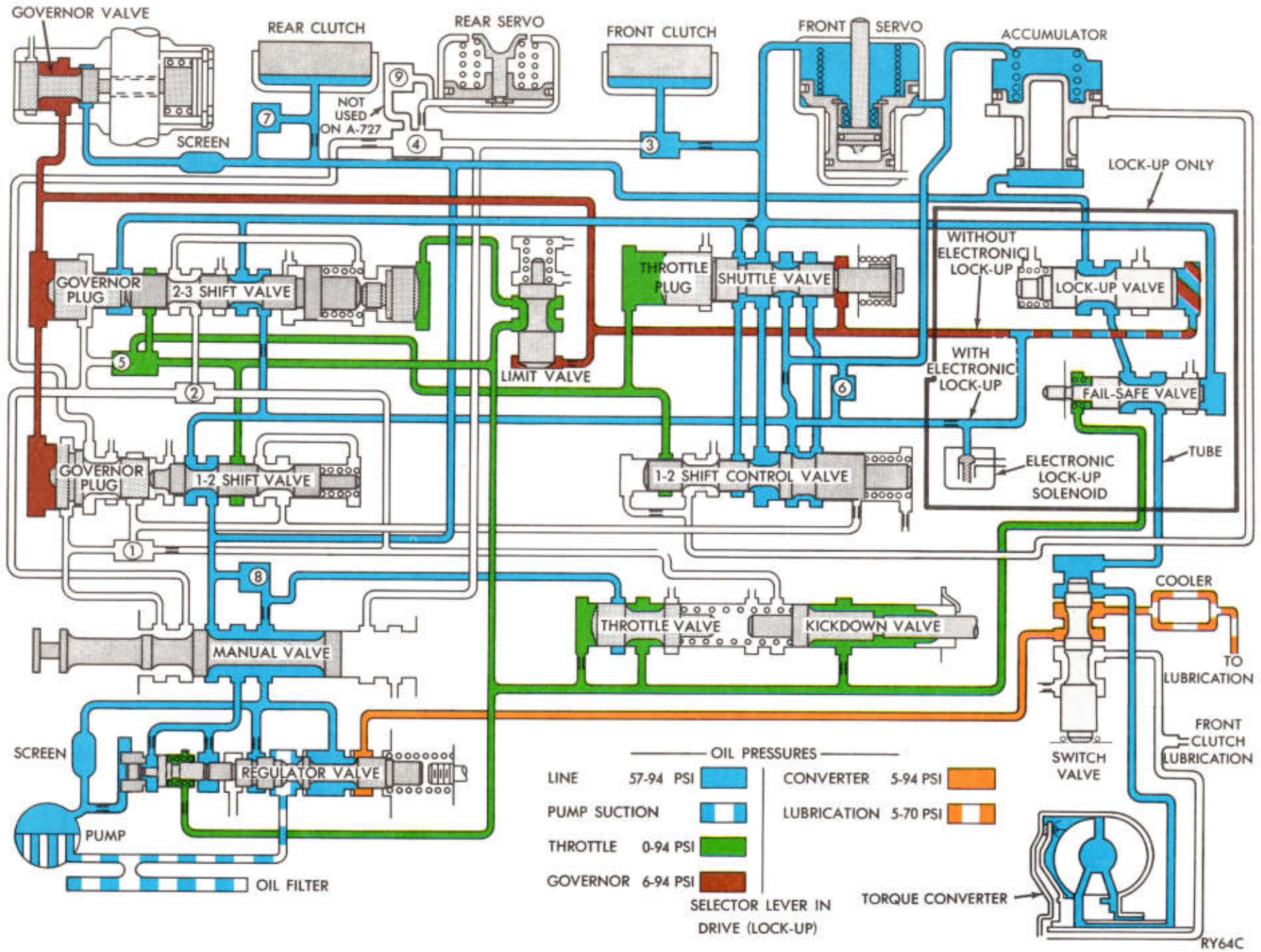


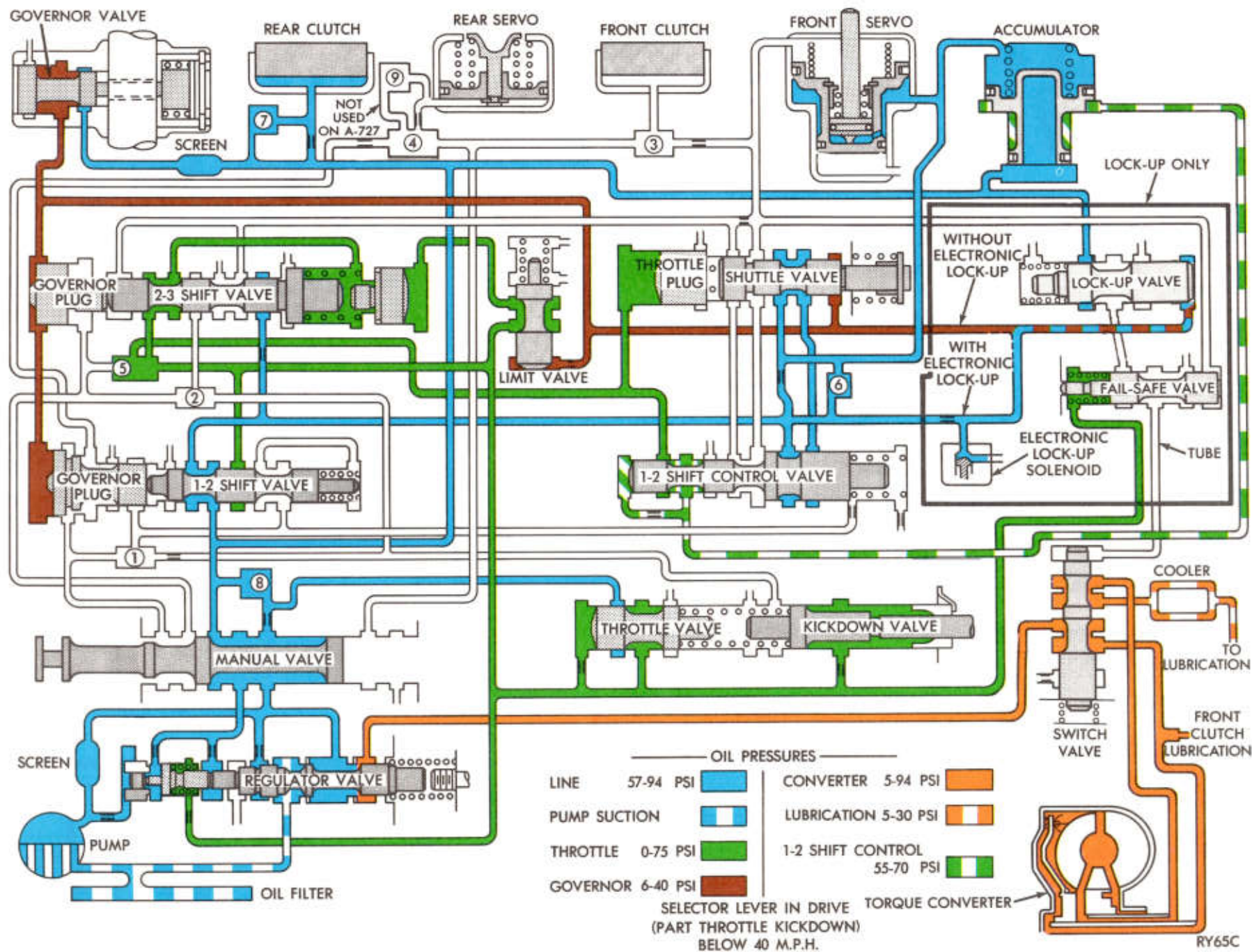


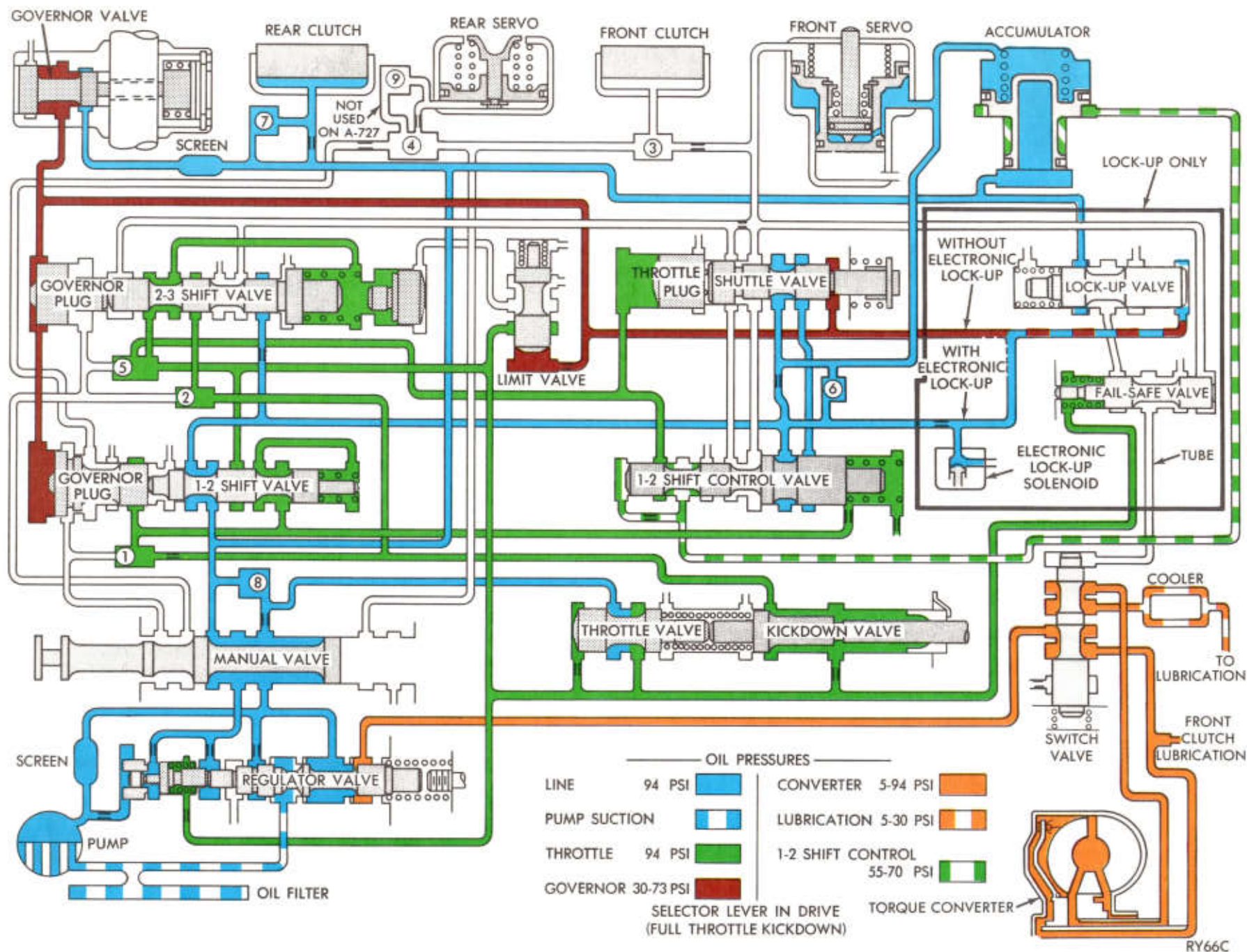


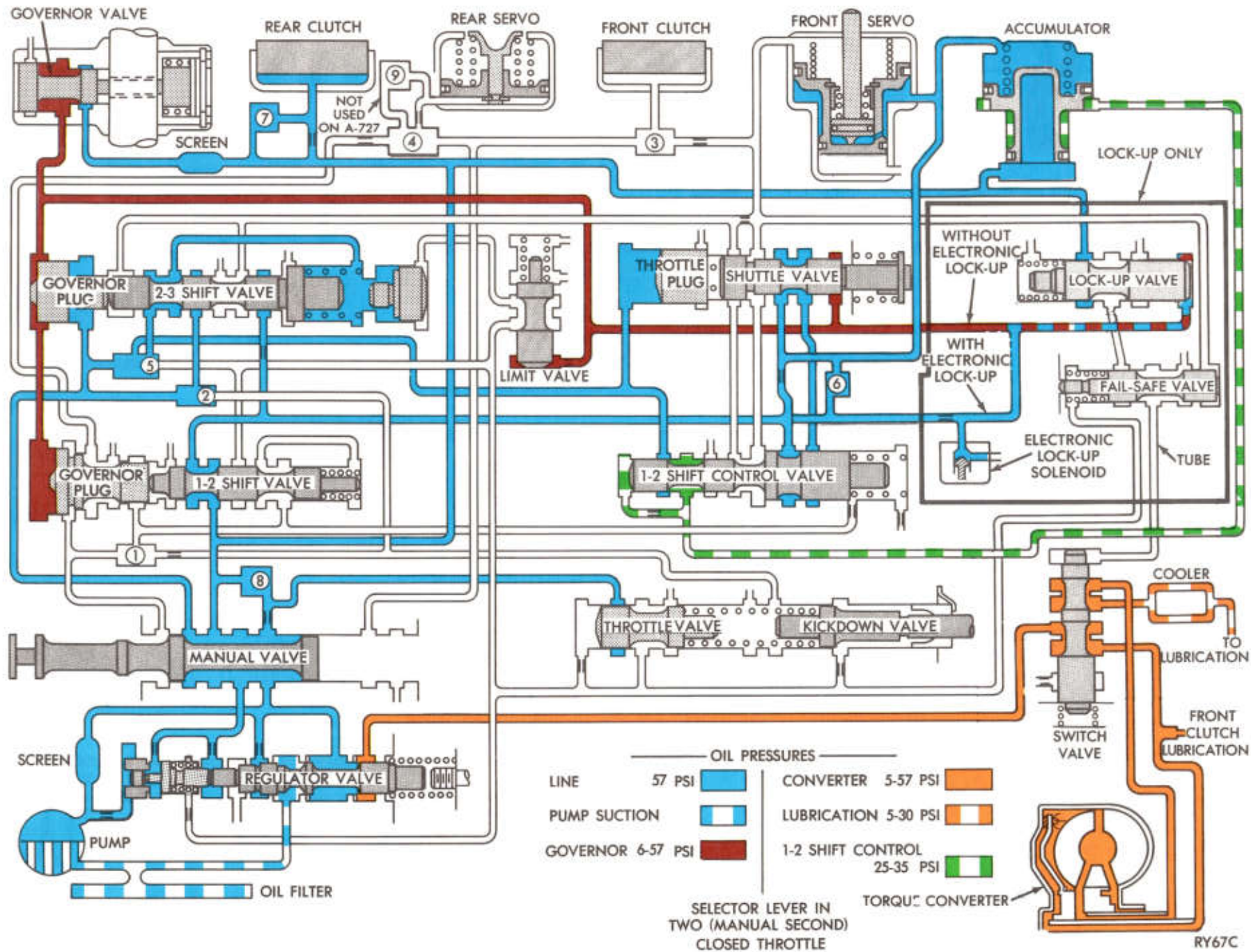
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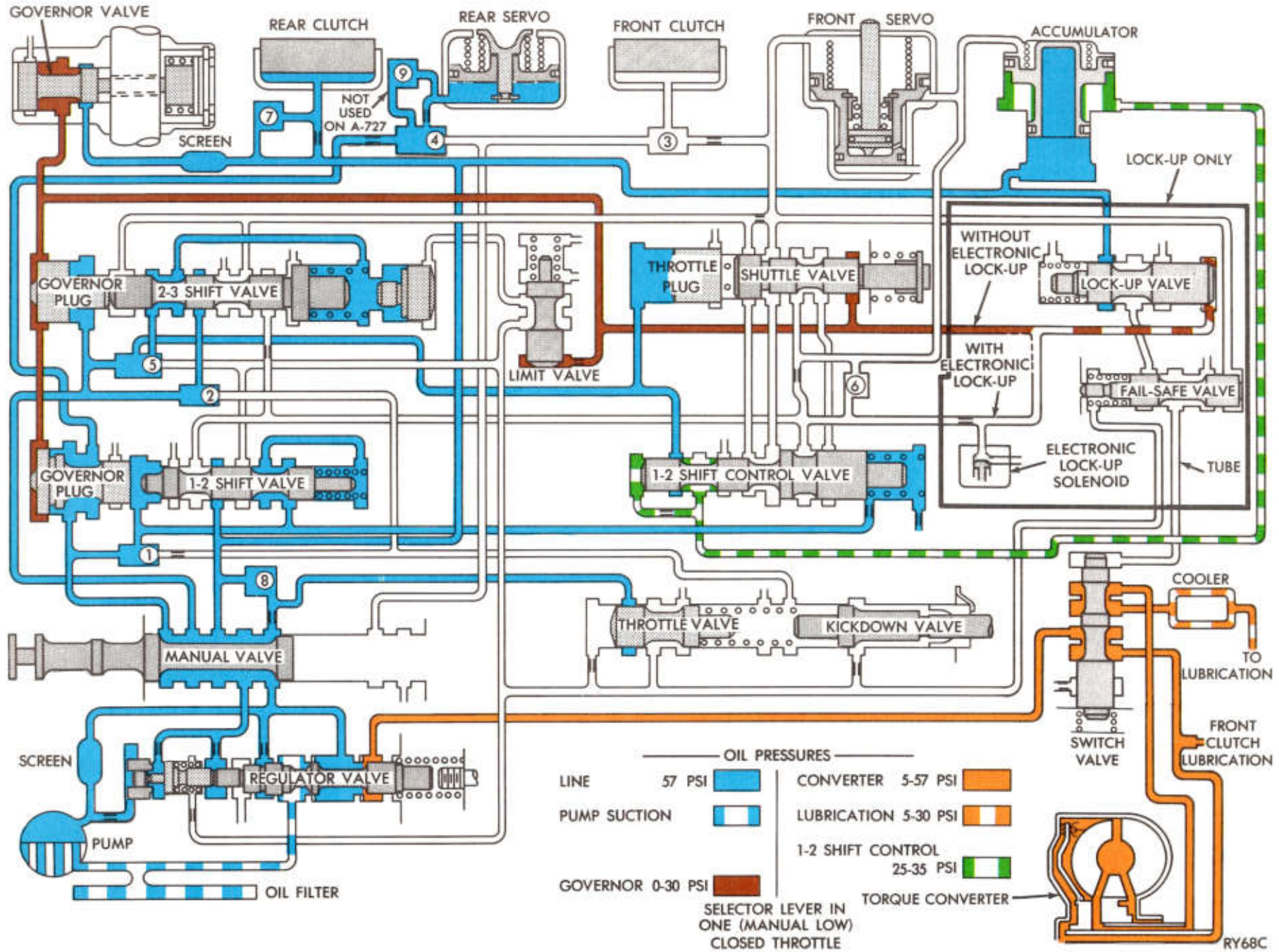


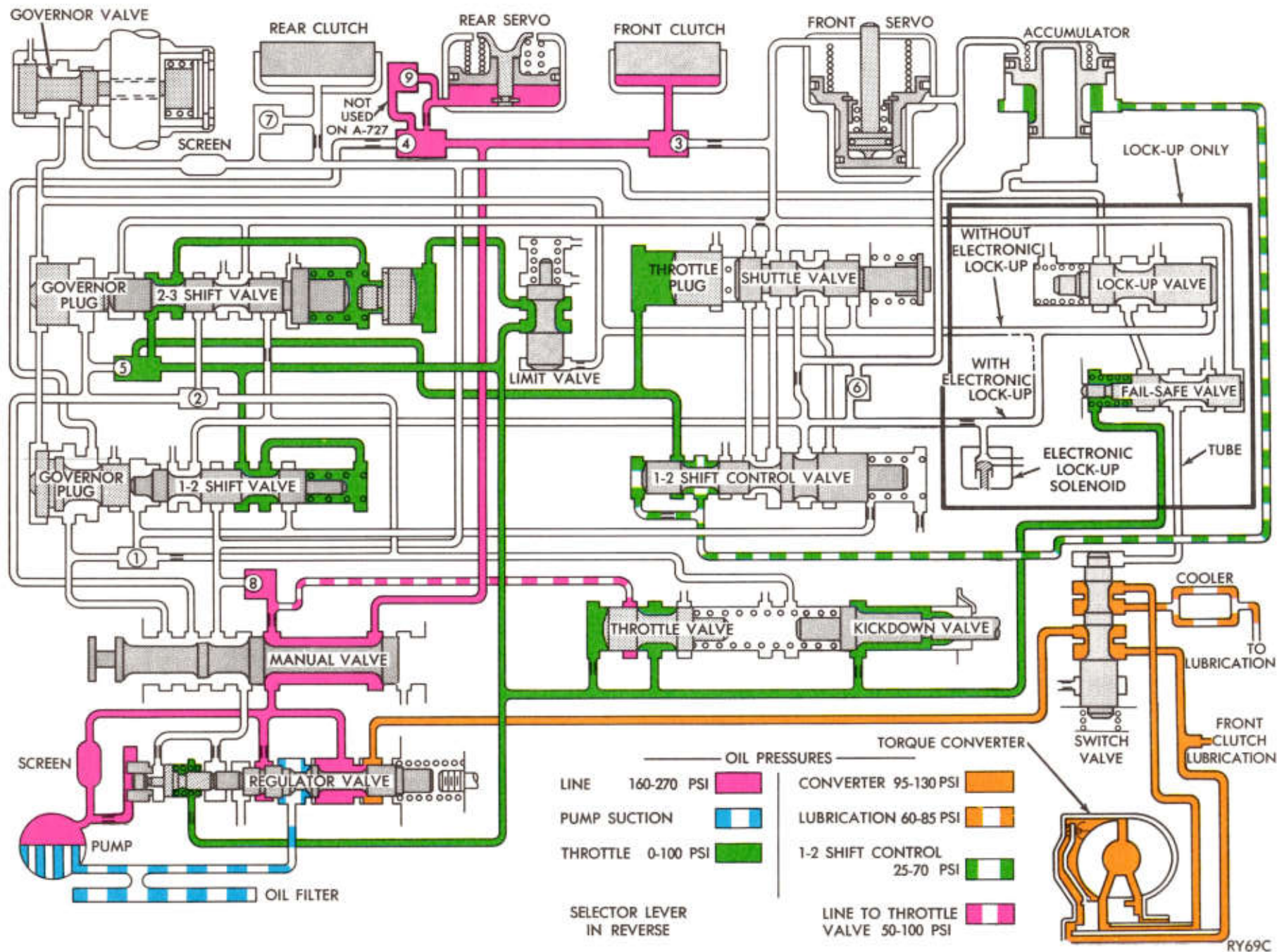






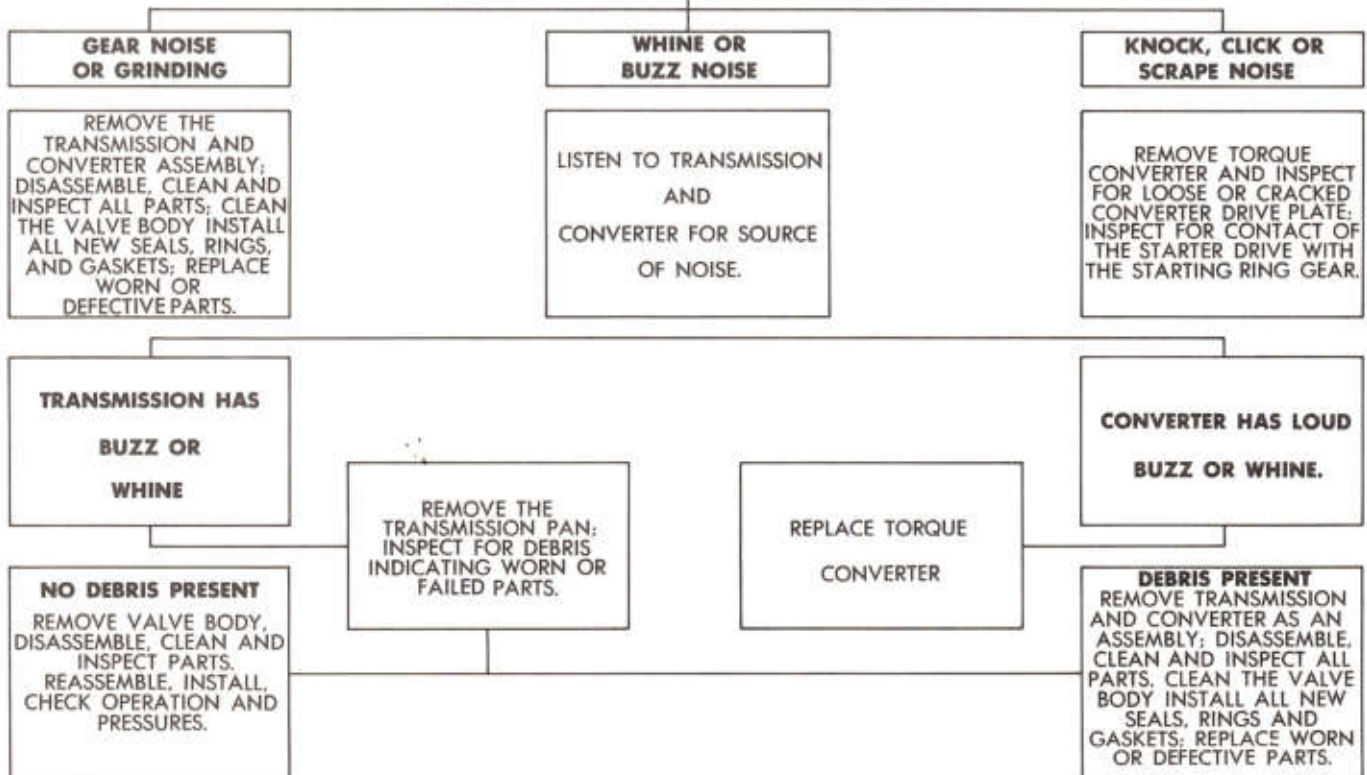






DIAGNOSIS GUIDE—ABNORMAL NOISE

INSPECT AND CORRECT THE TRANSMISSION FLUID LEVEL, ROAD TEST TO VERIFY THAT AN ABNORMAL NOISE EXISTS, IDENTIFY THE TYPE OF NOISE, DRIVING RANGES, AND CONDITIONS WHEN THE NOISE OCCURS.



PU566

DIAGNOSIS GUIDE— VEHICLE WILL NOT MOVE

CHECK THE TRANSMISSION FLUID LEVEL BEFORE STARTING THE ENGINE. IF NO FLUID IS VISIBLE ON THE DIP STICK, ADD FLUID TO THE "L" MARK BEFORE STARTING THE ENGINE. THEN START THE ENGINE WITH THE TRANSMISSION IN NEUTRAL AND LISTEN FOR NOISE.

NO ABNORMAL NOISE,
MOVE THE SELECTOR TO A FORWARD DRIVE RANGE AND OBSERVE THE PROPELLER SHAFT FOR TURNING.

ABNORMAL NOISE.
STOP ENGINE IMMEDIATELY. REMOVE TRANSMISSION AND CONVERTER AS AN ASSEMBLY; DISASSEMBLE, CLEAN AND INSPECT ALL PARTS; CLEAN THE VALVE BODY, INSTALL ALL NEW SEALS, RINGS, AND GASKETS; REPLACE WORN OR DEFECTIVE PARTS.

PROPELLER SHAFT TURNS
BUT REAR WHEELS
DO NOT TURN, INSPECT
FOR BROKEN REAR
AXLE PARTS.

**PROPELLER SHAFT DOES
NOT TURN.**
REMOVE THE
TRANSMISSION OIL PAN.
INSPECT FOR DEBRIS.

NO DEBRIS
REMOVE VALVE BODY.
DISASSEMBLE CLEAN AND
INSPECT ALL PARTS.
REASSEMBLE, INSTALL AND
CHECK PRESSURES AND
OPERATION.

DEBRIS IS PRESENT.
REMOVE THE TRANSMISSION AND
CONVERTER AS AN ASSEMBLY.
DISASSEMBLE, CLEAN AND INSPECT
ALL PARTS. CLEAN VALVE BODY;
INSTALL ALL NEW SEALS, RINGS
AND GASKETS; REPLACE WORN OR
DEFECTIVE PARTS.

PU567

DIAGNOSIS GUIDE— FLUID LEAKS

VISUALLY INSPECT FOR SOURCE OF LEAK. IF THE SOURCE OF LEAK CANNOT BE READILY DETERMINED, CLEAN THE EXTERIOR OF THE TRANSMISSION. CHECK TRANSMISSION FLUID LEVEL. CORRECT IF NECESSARY.

THE FOLLOWING LEAKS MAY BE CORRECTED WITHOUT REMOVING THE TRANSMISSION:

MANUAL LEVER SHAFT OIL SEAL
FILLER TUBE 'O' RING
PRESSURE GAUGE PLUG
NEUTRAL START SWITCH
PAN GASKET
OIL COOLER FITTINGS
EXTENSION HOUSING TO CASE GASKET
EXTENSION HOUSING TO CASE BOLTS
EXTENSION HOUSING YOKE SEAL
SPEEDOMETER ADAPTER 'O' RING
FRONT BAND ADJUSTING SCREW

THE FOLLOWING LEAKS
REQUIRE REMOVAL OF THE TRANSMISSION
AND TORQUE CONVERTER FOR
CORRECTION.
TRANSMISSION FLUID LEAKING FROM THE LOWER
EDGE OF THE CONVERTER HOUSING; CAUSED BY
FRONT PUMP SEAL, PUMP TO CASE SEAL, OR TORQUE
CONVERTER WELD.
CRACKED OR
POROUS TRANSMISSION CASE.

PU568

21-61

FAULTY OIL PUMP	X			X	X		X				X
STICKING GOVERNOR VALVE	X	X	X								
PLUGGED COOLER, LINES OR FITTINGS					X					X	X
VALVE BODY MALFUNCTION	X	X	X	X	X		X				X
STUCK SWITCH VALVE	X	X	X	X	X					X	
STUCK LOCKUP VALVE	X	X	X								
STUCK FAIL-SAFE VALVE	X	X	X	X							
STUCK LOCKUP SOLENOID	X		X								
SOLENOID WIRING DISCONNECTED	X										
FAILED LOCKUP SOLENOID	X										
FAILED LOCKUP RELAY	X		X								
FAULTY TORQUE CONVERTER:	X					X	X	X			X
OUT OF BALANCE									X		
FAILED LOCKING CLUTCH	X					X					X
LEAKING TURBINE HUB SEAL	X					X					
ALIGN EXHAUST SYSTEM								X			X
TUNE ENGINE							X	X			X
FAULTY INPUT SHAFT OR SEAL RING	X				X						
THROTTLE LINKAGE MISADJUSTED								X			X
CONDITION	NO LOCKUP	WILL NOT UNLOCK	STAYS LOCKED UP TO TOO LOW A SPEED IN DIRECT	LOCKS UP OR DRAGS IN LOW OR SECOND	STALLS OR IS SLUGGISH IN REVERSE	LOUD CHATTER DURING LOCKUP ENGAGEMENT—(COLD)	VIBRATION OR SHUDDER DURING LOCKUP ENGAGEMENT	VIBRATIONS AFTER LOCKUP ENGAGEMENT	VIBRATION WHEN "REVED" IN NEUTRAL	OVERHEATING; OIL BLOWING OUT DIPSTICK OR PUMP SEAL	SHUDDER AFTER LOCKUP ENGAGEMENT

CONDITION

MAINTENANCE AND ADJUSTMENTS

INDEX

	Page
Band Adjustments	63
Gearshift Linkage Adjustments	62
Hydraulic Control Pressure Adjustments	64

	Page
Lubrication	62
Throttle Rod Adjustments	63

LUBRICATION

Inspect fluid level on dipstick every six months with engine idling and transmission in neutral position and vehicle on **level** ground. A properly filled transmission will read near the "add" mark when fluid temperature is 70 degree fahrenheit (21 degrees Celsius) and near (but not over) the "full" mark at 180 degrees fahrenheit (82 degrees Celsius) (average operating temperature).

Fluid and Filter Changes

Refer to "Lubrication and Maintenance" Group O, for mileage intervals.

Severe usage as defined below, requires that fluid and filter be changed and bands adjusted every 12,000 miles (19 000 kilometers).

- (1) More than 50% operation in heavy city traffic during hot weather (above 90°F.) (32°C.).
- (2) Commercial Type Operation, and Trailer Tow.

NOTES:

- (1) When the factory fill fluid is changed as recommended above, MOPAR ATF PLUS (Automatic Transmission Fluid) Type 7176 should be used. A band adjustment and filter change should be made at the time of the oil change.
- (2) If the transmission is disassembled for any reason, the fluid and filter should be changed, and the bands adjusted.

Drain and Refill

- (1) Raise vehicle on a hoise. Place a drain container with a large opening, under transmission oil pan.
- (2) Loosen pan bolts and tap the pan at one corner to break it loose allowing fluid to drain, then remove the oil pan.
- (3) If necessary, adjust the reverse band.
- (4) Install a new filter on bottom of the valve body and tighten retaining screws to 35 in. lbs. (4 N·m).
- (5) Clean the oil pan. Make sure the round magnet is located over the bump in the front, right hand corner of the oil pan. Install oil pan using a new gasket. Tighten oil pan bolts to 150 in. lbs. (17 N·m).
- (6) Pour four quarts of MOPAR ATF PLUS (Automatic Transmission Fluid) Type 7176 through the filler tube.
- (7) Start engine and allow to idle for at least two minutes. Then, with parking brake on, move selector

lever momentarily to each position, ending in the neutral position.

- (8) Add sufficient fluid to bring level to the "add" mark.

Recheck fluid level after transmission is at normal operating temperature. The level should be between the "full" mark and "add" mark with vehicle on **level** ground.

To prevent dirt from entering transmission, make certain that dipstick cap is fully seated onto the filler tube.

GEARSHIFT LINKAGE ADJUSTMENT (Column Shift)(Fig. 1)

When it is necessary to disassemble linkage rods from levers which use plastic grommets as retainers, the grommets should be replaced with new ones. Use a prying tool to force rod from grommet in lever (pry only where grommet and rod attach—not on the rod itself), then cut away old grommet. Use pliers to snap new grommet into lever and rod into grommet.

- (1) To insure proper adjustment, make sure adjustable swivel block is free to turn on shift rod. Disassemble and clean or repair parts to assure free action, if necessary.
- (2) Place gearshift lever in "P" (park) position.
- (3) With all linkage assembled and the adjustable

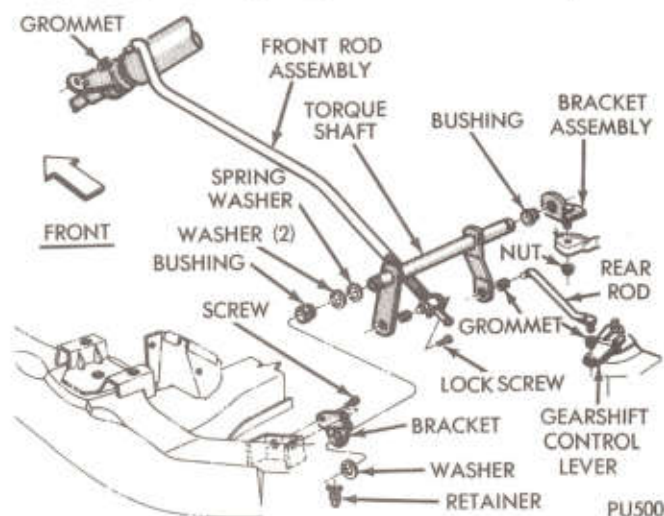


Fig. 1—Column Gearshift Linkage Adjustment

swivel lock bolt loose, move shift lever on transmission all the way to rear detent (park) position.

(4) Tighten adjustment swivel lock bolt to 90 in. lbs. (10 N·m).

(5) Check adjustment as follows:

(a) Detent position for neutral and drive should be within limits of hand lever gate stops.

(b) Key start must occur only when shift lever is in "PARK" or "NEUTRAL" positions.

THROTTLE ROD ADJUSTMENT

With engine at operating temperature adjust idle speed of engine using a tachometer. Refer to "Fuel System" Group 14, for idle speed Specifications and carburetor linkage adjustment (if so equipped).

ADJUSTMENT PROCEDURE (Fig. 2)

(1) Perform transmission throttle rod adjustment while engine is at normal operating temperature otherwise make sure carburetor is not on fast idle cam (if so equipped).

(2) Raise vehicle on hoist to make adjustment at transmission throttle lever.

(3) Loosen adjustment swivel lock screw.

(4) To insure proper adjustment, swivel must be free to slide along flat end of throttle rod so that preload spring action is not restricted. Disassemble

and clean, or repair, parts to assure free action, if necessary.

(5) Hold transmission lever firmly forward against its internal stop and tighten swivel lock screw to 100 in. lbs. (11 N·m).

(6) The adjustment is finished and linkage backlash was automatically removed by the preload spring.

(7) If lubrication is required, refer to Lubrication Group 0.

(8) Lower vehicle, reconnect choke if disconnected, and test linkage freedom of operation by moving throttle rod rearward, slowly releasing it to confirm it will return fully forward.

BAND ADJUSTMENTS

Kickdown Band (Front)

The kickdown band adjusting screw is located on left side of the transmission case (Fig. 3).

(1) Loosen lock nut and back off lock nut approximately five turns. Test adjusting screw for free turning in the transmission case.

(2) Using wrench, Tool C-3380-A with adapter C-3705, tighten band adjusting screw 47 to 50 in. lbs. (5 N·m). If adapter C-3705 is not used, tighten adjusting screw to 72 in. lbs. (8 N·m) which is the true torque.

(3) Back off adjusting screw the number of turns listed in "Specifications". Hold adjusting screw in this position and tighten lock nut to 30 ft. lbs. (41 N·m).

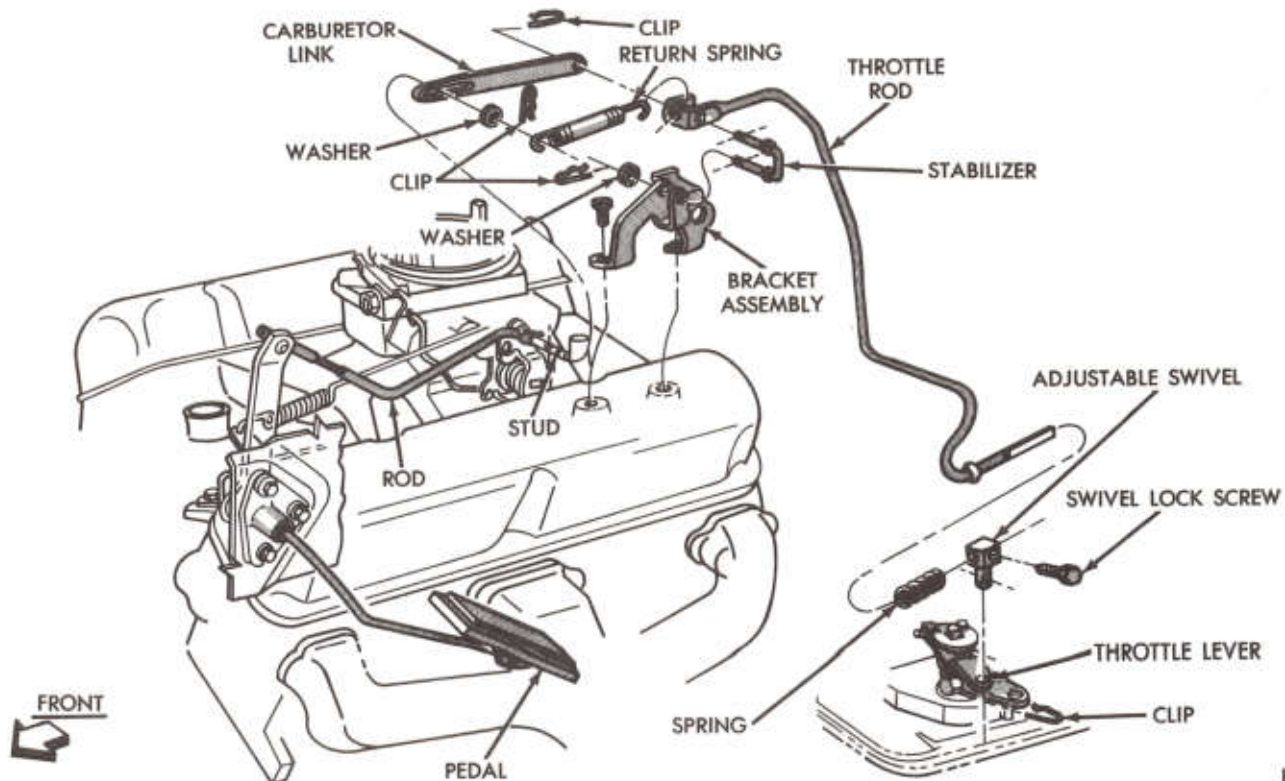


Fig. 2—Throttle Rod Adjustment

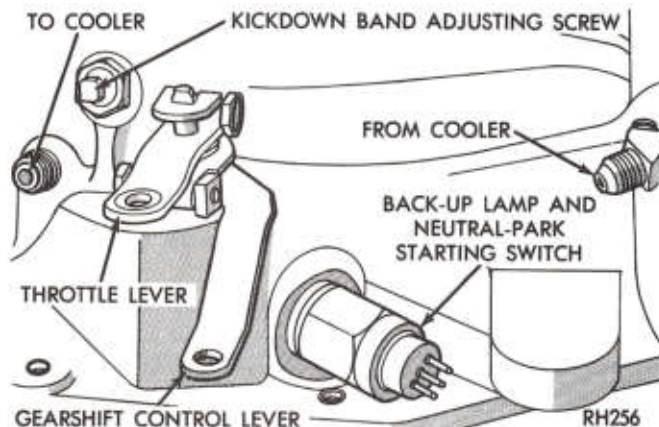


Fig. 3—External Controls and Adjustments

Low-Reverse Band (Rear)

- (1) Raise vehicle, drain transmission fluid from loosened oil pan and remove oil pan.
- (2) Loosen adjusting screw lock nut and back off lock nut approximately five turns (Fig. 4). Test adjusting screw for free turning in the lever.
- (3) Using wrench, Tool C-3380-A, tighten band adjusting screw to 72 in. lbs. (8 N·m).
- (4) Back off adjusting screw the number of turns listed in "Specifications". Hold adjusting screw in this position and tighten lock nut to 25 ft. lbs. (34 N·m).
- (5) Reinstall oil pan using a new gasket. Tighten oil pan bolts to 150 in. lbs. (17 N·m).
- (6) Fill transmission with MOPAR ATF PLUS (Automatic Transmission Fluid) Type 7176.

HYDRAULIC CONTROL PRESSURE ADJUSTMENTS**Line Pressure**

An incorrect throttle pressure setting will cause incorrect line pressure readings even though line pressure adjustment is correct. Always inspect and correct throttle pressure adjustment before adjusting the line pressure.

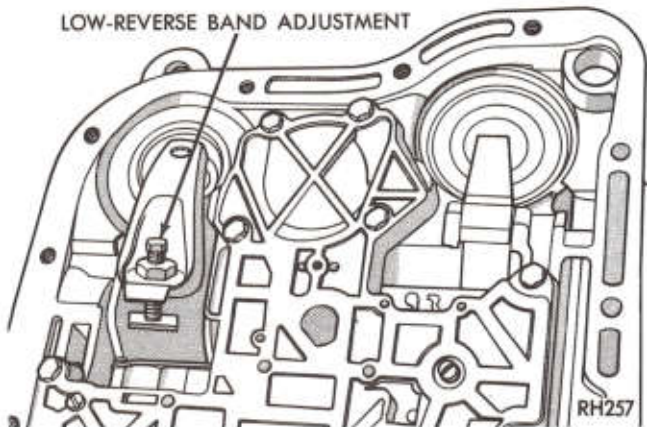


Fig. 4—Low-Reverse Band Adjustment

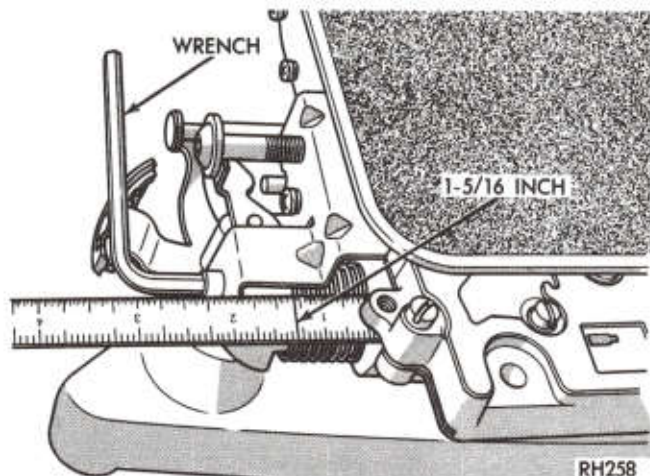


Fig. 5—Line Pressure Adjustment

The approximate adjustment is 1-5/16 inches, measured from valve body to inner edge of adjusting nut (Fig. 5). However, due to manufacturing tolerances, the adjustment can be varied to obtain specified line pressure.

The adjusting screw may be turned with an Allen wrench. One complete turn of the adjusting screw changes closed throttle line pressure approximately 1-2/3 psi. Turning adjusting screw counterclockwise increases pressure, and clockwise decreases pressure.

Throttle Pressure

Throttle pressures cannot be tested accurately; therefore, the adjustment should be measured if a malfunction is evident.

- (1) Insert gauge pin of Tool C-3763 between the throttle lever cam and kickdown valve (Fig. 6).
- (2) By pushing in on tool, compress kickdown valve against its spring so throttle valve is completely bottomed inside the valve body.
- (3) As force is being exerted to compress spring,

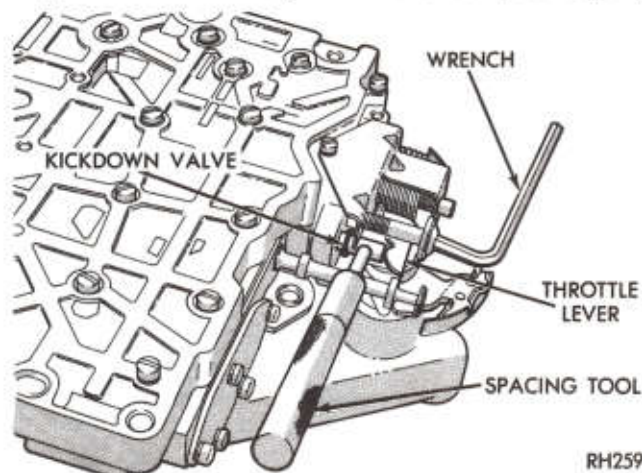


Fig. 6—Throttle Pressure Adjustment

turn throttle lever stop screw with allen wrench until head of screw touches the throttle lever tang with throttle lever cam touching tool and the throttle valve

bottomed. Be sure adjustment is made with spring fully compressed and valve bottomed in the valve body.

SERVICE IN VEHICLE

INDEX

	Page		Page
Aluminum Thread Repair	74	Parking Lock Components	68
Extension Housing Bushing and Output Shaft Bearing	67	Speedometer Pinion Gear	65
Extension Housing Yoke Seal	67	Valve Body and Accumulator Piston Installation ..	74
Governor and Parking Gear	67	Valve Body and Accumulator Piston Removal	69
Manual Lever Shaft Seal	69	Valve Body Disassembly	69
Neutral Starting and Back-up Lamp Switch	66	Valve Body Reassembly	73

GENERAL INFORMATION

Various transmission components can be removed for repairs without removing the transmission from the vehicle. The removal, reconditioning, and installation procedures for these components are covered here.

SPEEDOMETER PINION GEAR

Any time the speedometer pinion adapter is removed, a **NEW O-ring** (black in color) must be installed on the outside diameter of the adapter.

Removal and Installation

Rear axle gear ratio and tire size determines pinion gear requirements.

- (1) Place drain pan under speedometer adapter.
- (2) Remove bolt and retainer securing speedometer pinion adapter in the extension housing (Fig. 1).

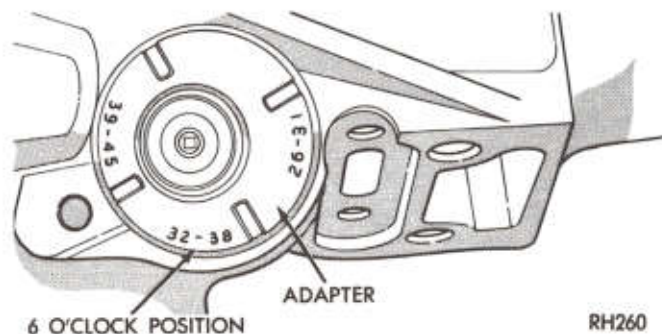


Fig. 1—Speedometer Pinion and Adapter

- (3) With cable housing connected, carefully work adapter and pinion out of the extension housing.

- (4) If transmission fluid is found in cable housing, replace seal in the adapter (Fig. 2). Start seal and retainer ring in the adapter, then push them into adapter with Tool C-4004 until tool bottoms (Fig. 3).

Before installing pinion and adapter assembly,

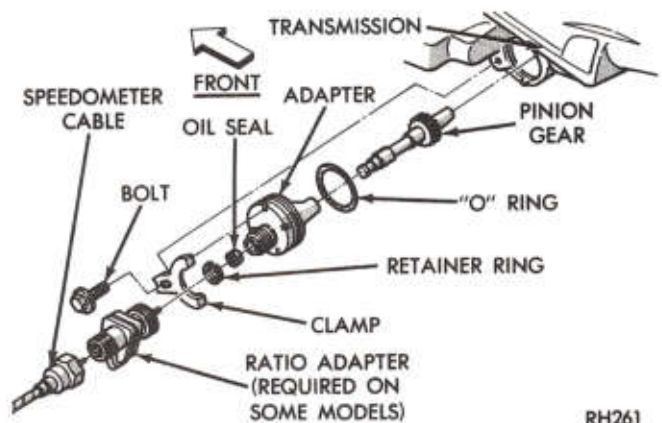


Fig. 2—Speedometer Drive

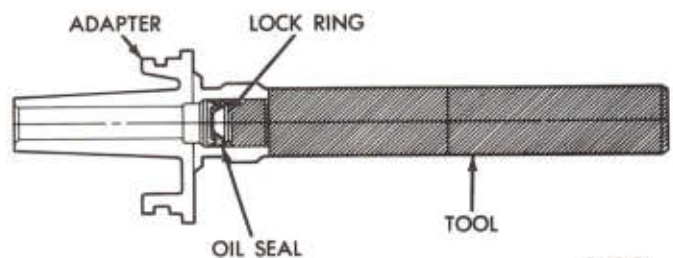


Fig. 3—Install Speedometer Pinion Seal

make sure adapter flange and its mating area on extension housing are perfectly clean. Dirt or sand will cause misalignment resulting in speedometer pinion gear noise.

- (5) Note number of gear teeth and install speedometer pinion gear into adapter.

- (6) Rotate the speedometer pinion gear and adapter assembly so that the number on the adapter, corresponding to the number of teeth on the gear, is in the 6 o'clock position as the assembly is installed (Fig. 1).

- (7) Install retainer and bolt, with retainer tangs in

adapter positioning slots. Tap adapter firmly into the extension housing and tighten retainer bolt to 100 in. lbs. (11 N·m). Refill transmission.

NEUTRAL STARTING AND BACK-UP LAMP SWITCH (Fig. 4)

Replacement and Test

The neutral starting switch is the center terminal of the 3-terminal switch. It provides ground for the starter solenoid circuit through the selector lever in only PARK and NEUTRAL positions.

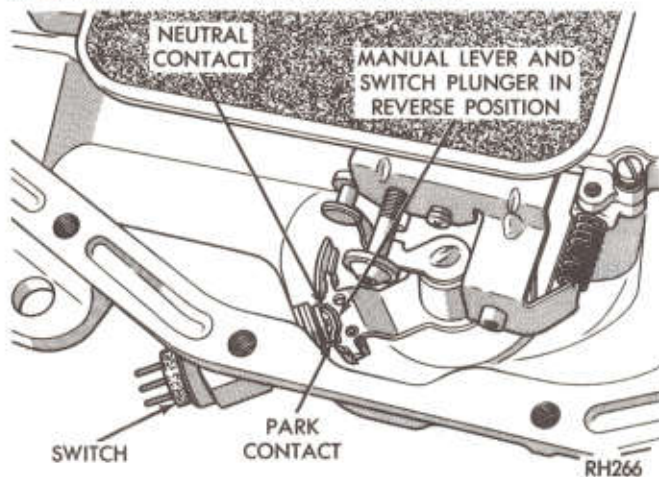


Fig. 4—Start and Back-Up Lamp Switch

(1) To test switch, remove wiring connector from switch and test for continuity between center pin of switch and transmission case. Continuity should exist only when transmission is in PARK or NEUTRAL.

(2) Check gearshift linkage adjustment before replacing a switch that tests bad.

(3) Unscrew switch from transmission case allowing fluid to drain into a container. Move selector lever to PARK and then to NEUTRAL positions, and inspect to see that the switch operating lever fingers are centered in switch opening in the case.

(4) Screw switch with new seal into transmission case and tighten to 25 ft. lbs. (34 N·m). Retest switch with the test lamp.

(5) Add automatic transmission fluid to transmission to bring up to proper level.

(6) The back-up lamp switch circuit is through the two outside terminals of the 3-terminal switch.

(7) To test switch, remove wiring connector from switch and test for continuity between the two outside pins.

(8) Continuity should exist only with transmission in Reverse position.

(9) No continuity should exist from either pin to the case.

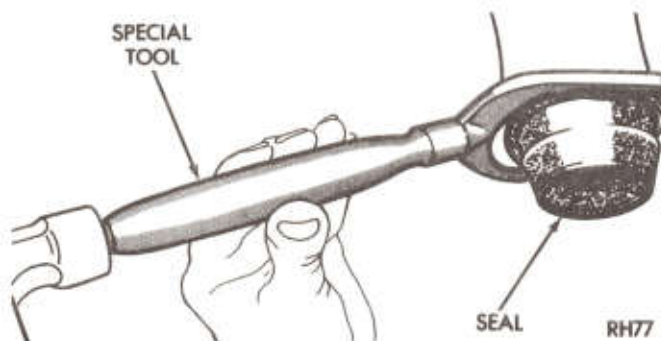


Fig. 5—Remove Extension Seal

EXTENSION HOUSING YOKE SEAL

Replacement

(1) Mark parts for reassembly then disconnect the propeller shaft at rear universal joint. Carefully pull shaft yoke out of the transmission extension housing.

Be careful not to scratch or nick ground surface on sliding spline yoke during removal and installation of the shaft assembly.

(2) Remove oil seal with Tool C-3985 (Fig. 5).

(3) To install a new seal, position seal in opening of extension housing and drive it into the housing with Tool C-3995 or C-3972 (Fig. 6).

(4) Carefully guide front universal joint yoke into extension housing and on the mainshaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion shaft yoke.

EXTENSION HOUSING BUSHING AND OUTPUT SHAFT BEARING

Extension Removal

(1) Mark parts for reassembly then disconnect propeller shaft at rear universal joint. Carefully pull shaft assembly out of the extension housing.

(2) Remove speedometer pinion and adapter assembly (Fig. 1). Drain approximately two quarts of fluid from the transmission.

(3) Remove bolts securing extension housing to the crossmember. Raise transmission slightly with service jack, then remove center crossmember and support assembly.

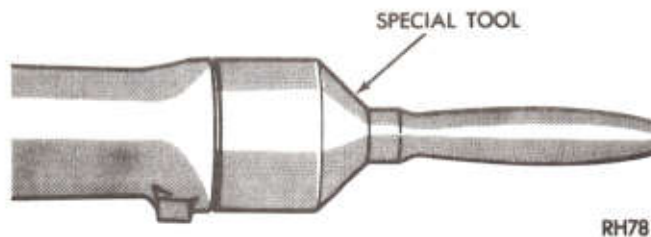


Fig. 6—Install Extension Seal

(4) Remove extension housing to transmission bolts.

When removing or installing extension housing (step 6), the gearshift lever must be in "1" (low) position. This positions parking lock control rod rearward so it can be disengaged or engaged with the parking lock sprag.

(5) Remove screws, plate, and gasket from bottom of extension housing mounting pad. Spread large snap ring from output shaft bearing (Fig. 7).

With snap ring spread as far as possible, carefully tap extension housing off the output shaft bearing. Carefully pull extension housing rearward, to allow parking lock control rod knob to clear parking sprag, then remove the housing.

Bearing Replacement

(1) Using heavy-duty snap ring pliers, remove the output shaft bearing rear snap ring and remove bearing from the shaft (Fig. 8).

(2) Install a new bearing on shaft with outer race ring groove toward front, then install rear snap ring. A-727 has a snap ring in front of bearing; A-904T and A-999 do not.

Bushing Replacement

(1) Remove oil seal with Tool C-3985 (Fig. 5).

(2) **A-904T and A-999:** Press or drive out bushing with Tool C-3996 (Fig. 9).

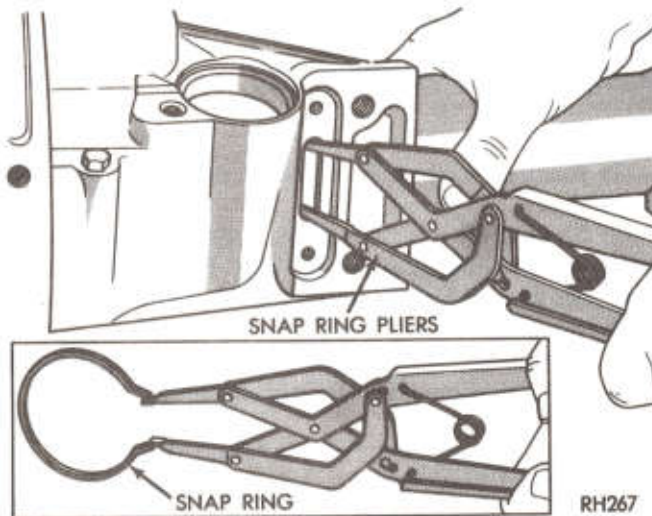


Fig. 7—Remove or Install Extension

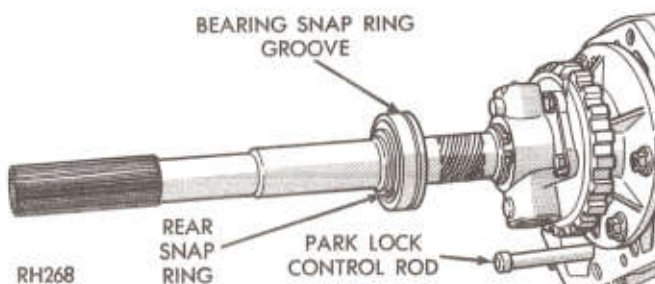


Fig. 8—Output Shaft Bearing

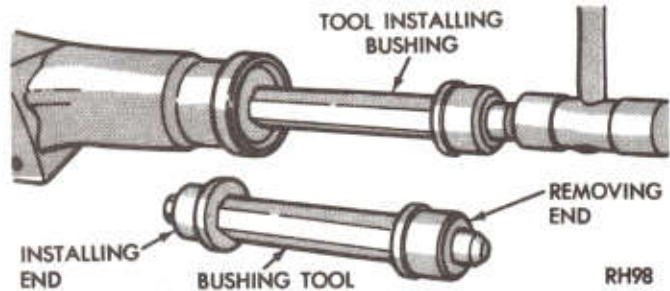


Fig. 9—Replace Extension Housing Bushing

A-727: Remove bushing in the same manner with Tool C-3974.

(3) **A-904T and A-999:** Slide a new bushing on installing end of Tool C-3996. Align oil hole in bushing with oil slot in the housing, then press or drive bushing into place (Fig. 9).

A-727: Using Tool C-3974, install a new bushing in same manner.

(4) **A-904T and A-999:** Drive a new oil seal into housing with Tool C-3995 (Fig. 6).

A-727: Using Tool C-3972, install a new oil seal in same manner.

Extension Installation

(1) Place a new extension housing gasket on the transmission case. Position the output shaft bearing retaining snap ring in extension housing. Slide extension housing on output shaft guiding the parking lock control rod knob past the parking sprag. While spreading large snap ring in housing (Fig. 7), carefully tap housing into place, then release the snap ring. Make sure snap ring is fully seated in bearing outer race ring groove.

(2) Install and tighten extension housing bolts to 32 ft. lbs. (43 N·m).

(3) Install gasket, plate, and screws on bottom of the extension housing mounting pad.

(4) Install the center crossmember and rear mount assembly, tighten retaining bolts. Lower transmission to install extension housing to support bolts and tighten to 50 ft. lbs. (68 N·m).

(5) Install the speedometer pinion and adapter.

(6) Carefully guide front universal joint yoke into extension housing and on the output shaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion shaft yoke.

(7) Add automatic transmission fluid to transmission to bring up to proper level.

GOVERNOR AND PARKING GEAR

Removal

(1) Remove extension housing and output shaft bearing as previously described.

(2) Carefully pry snap ring from weight end of

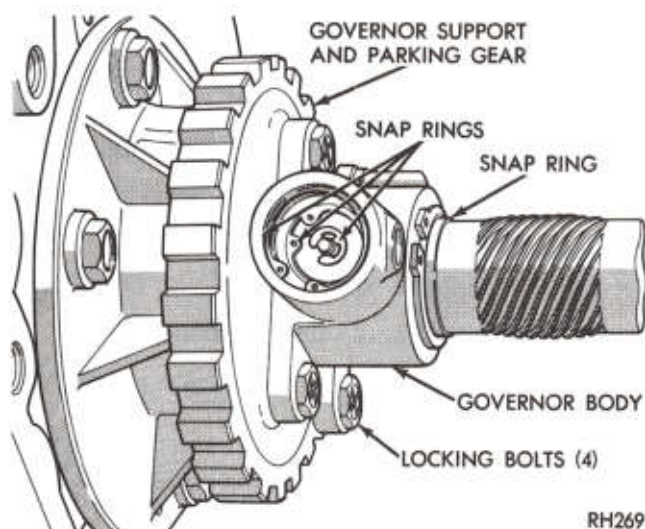


Fig. 10—Governor Snap Rings

governor valve shaft (Fig. 10). Slide valve and shaft assembly out of governor body.

(3) Remove large snap ring from weight end of governor body, lift out governor weight assembly.

(4) Remove snap ring from inside governor weight, remove inner weight and spring from the outer weight. Figure 11 shows a disassembled view of the governor assembly.

(5) Remove snap ring from behind governor body, then slide governor and support assembly off the output shaft. Remove the four bolts and separate governor body and screen from the parking gear.

Cleaning and Inspection

Figure 11 shows a disassembled view of the governor assembly.

Inspect all parts for burrs and wear. Inspect inner weight for free movement in outer weight, and outer weight for free movement in governor body. Inspect valve for free movement in governor body. The weights and valve should fall freely in the bores when clean and dry. Rough surfaces may be removed with crocus cloth. Wash governor screen. Inspect governor

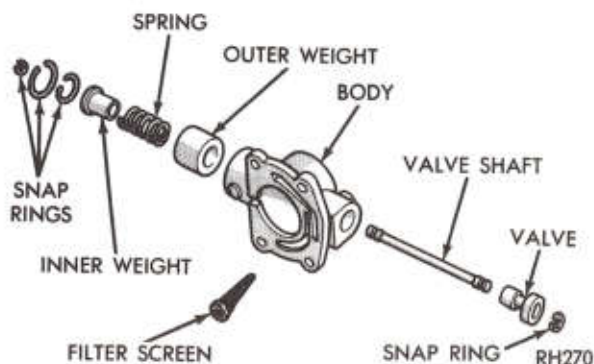


Fig. 11—Governor Assembly

seal rings for wear on sides and outside diameter.

Inspect governor weight spring for distortion. Inspect lugs on support gear for broken edges or other damage. Thoroughly clean all governor parts in clean solvent and test for free movement before assembly.

Installation

(1) Assemble governor body and screen to the support and tighten bolts finger tight. Make sure oil passage of governor body aligns with passage in the support.

(2) Position support and governor assembly on the output shaft. Align assembly so valve shaft hole in governor body aligns with hole in the output shaft, then slide assembly into place. Install snap ring behind governor body (Fig. 10). Tighten the body to support bolts to 95 in. lbs. (11 N·m). The support bolts have a self-locking nylon patch and can be reused.

(3) Assemble governor weights and spring, and secure with snap ring inside of large governor weight. Place weight assembly in governor body and install snap ring.

(4) Place governor valve on the valve shaft, insert assembly into the body and through governor weights. Install valve shaft retaining snap ring. Inspect valve and weight assembly for free movement after installation.

(5) Install output shaft bearing and extension housing as previously described.

PARKING LOCK COMPONENTS

Removal

(1) Remove extension housing as previously described.

(2) Slide shaft out of extension housing to remove the parking sprag and spring (Fig. 12). Remove snap ring and slide the reaction plug and pin assembly out of the housing.

(3) To replace the parking lock control rod, refer to "Valve Body—Removal and Installation."

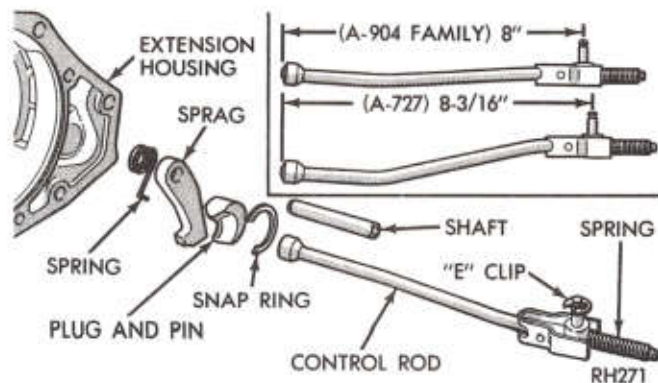


Fig. 12—Parking Lock Components

Inspection

Inspect sprag shaft for scores and free movement in the housing and sprag. Inspect sprag and control rod springs for distortion and tension. Inspect square lug on sprag for broken edges, also lugs on parking gear for damage. Inspect knob on end of control rod for nicks, burrs, and free turning.

Assembly

- (1) Install reaction plug and pin assembly in the housing and secure with snap ring (Fig. 12).
- (2) Position sprag and spring in housing and insert the shaft. Make sure square lug on sprag is toward parking gear, and spring is positioned so it moves sprag away from the gear.
- (3) Install extension housing.

VALVE BODY AND ACCUMULATOR PISTON REMOVAL

- (1) Raise vehicle on a hoist.
- (2) Loosen oil pan bolts, tap the pan to break it loose allowing fluid to drain, then remove oil pan.
- (3) Loosen clamp bolts and remove throttle and shift levers from transmission.
- (4) Pull wire connector from combination back-up lamp/neutral start switch.
- (5) Unscrew and remove switch from transmission case (Fig. 4).
- (6) Disconnect electronic lockup solenoid wire from inside of wiring connector at rear of transmission case, if so equipped.
- (7) Place a drain pan under transmission, then remove the ten hex-head valve body transmission case bolts. Hold valve body in position while removing the bolts.
- (8) While lowering valve body down out of transmission case, pull it forward out of the case. If necessary, rotate propeller shaft to align parking gear and sprag to permit knob on end of parking control rod to pass the sprag.
- (9) Remove accumulator piston and spring from transmission case. Inspect piston for nicks, scores, and wear. Inspect spring for distortion. Inspect rings for freedom in piston grooves and wear or breakage. Replace parts as required.

Manual Lever Shaft Seal

- (1) If valve body manual lever shaft oil seal requires replacement, drive it out of the case with a punch.
- (2) Drive a new seal into the case with a 15/16 inch socket and hammer (Fig. 13).

This seal can be replaced without removing the valve body from transmission by using a small screwdriver to pry seal out of its bore. Be careful not to scratch manual lever shaft or the seal bore in transmission.

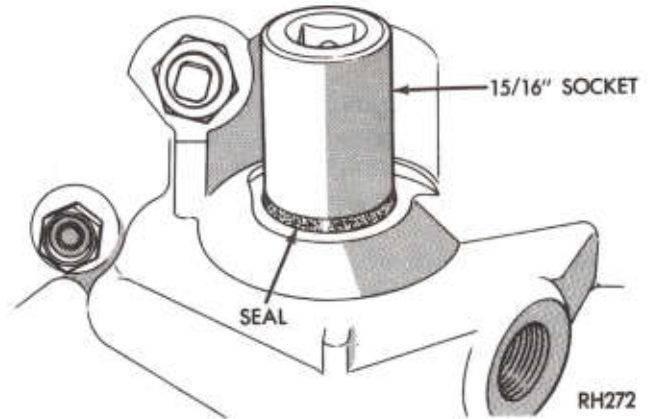


Fig. 13—Install Manual Lever Shaft Seal

VALVE BODY DISASSEMBLY

Tag all springs as they are removed for reassembly identification.

Do not clamp any portion of valve body or transfer plate in a vise. Any slight distortion of the aluminum body or transfer plate will result in sticking valves, excessive leakage or both. **When removing or installing valves or plugs, slide them in or out carefully. Do not use force.**

Remove E-clip and park control rod from manual lever.

Filter, Transfer Plate, and Pressure Regulators

- (1) Place valve body assembly on repair stand Tool C-3749 (Fig. 1). Remove three screws from the fluid filter and lift off filter.
- (2) Remove top and bottom screws from spring retainer and adjustment screw bracket.

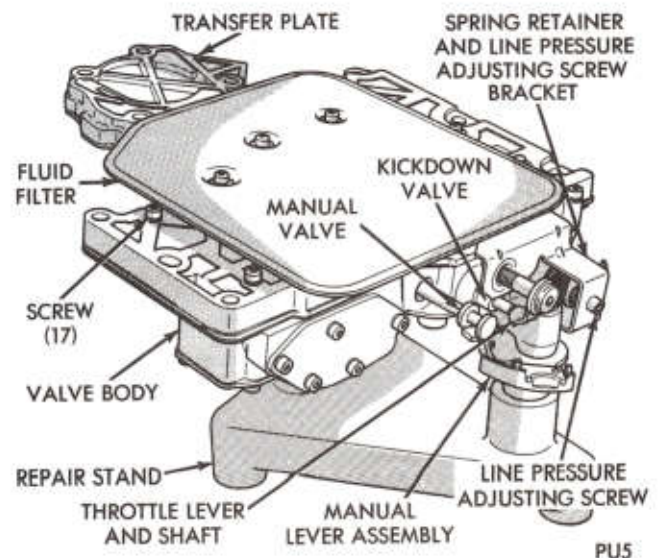


Fig. 1—Valve Body Assembly

(3) Hold spring retainer firmly against spring force while removing last retaining screw from side of valve body.

(4) Remove spring retainer, with line and throttle pressure adjusting screws (do not disturb setting) and the line pressure and switch valve regulator springs.

(5) Slide switch valve and regulator valve out of their bores.

(6) Remove screws from lockup module (or stiffener plate) and carefully remove tube and lockup module (or stiffener plate). Disassemble lockup module, tagging springs. Nonlockup A-904T, for California models, use an empty lockup body instead of a stiffener plate.

(7) Remove transfer plate retaining screws and lift off transfer plate and separator plate assembly.

(8) Remove lockup solenoid retaining screw and pull solenoid from its bore in transfer plate, if so equipped.

(9) Remove three screws from separator plate and separate parts for cleaning (Fig. 4).

(10) Remove rear clutch ball check, reverse servo ball check, and line pressure regulator valve screen

from separator plate for cleaning (Fig. 4).

(11) Remove the seven balls from valve body as shown in Figure 5.

LOCKUP MODULE (Fig. 3)

(1) Remove end cover.

(2) Remove lockup spring and valve.

(3) Remove fail-safe valve and spring.

Tag these springs as they are removed, for reassembly identification.

Shuttle Valve and Governor Plugs (Fig. 6)

(1) Turn valve body over and remove shuttle valve cover plate.

(2) Remove governor plug end plate (Fig. 6) and slide out the shuttle valve throttle plug and spring, the 1-2 shift valve governor plug and the 2-3 shift valve governor plug.

(3) Remove shuttle valve E-clip and slide shuttle valve out of its bore. Also, remove the secondary spring and guides which were retained by E-clip.

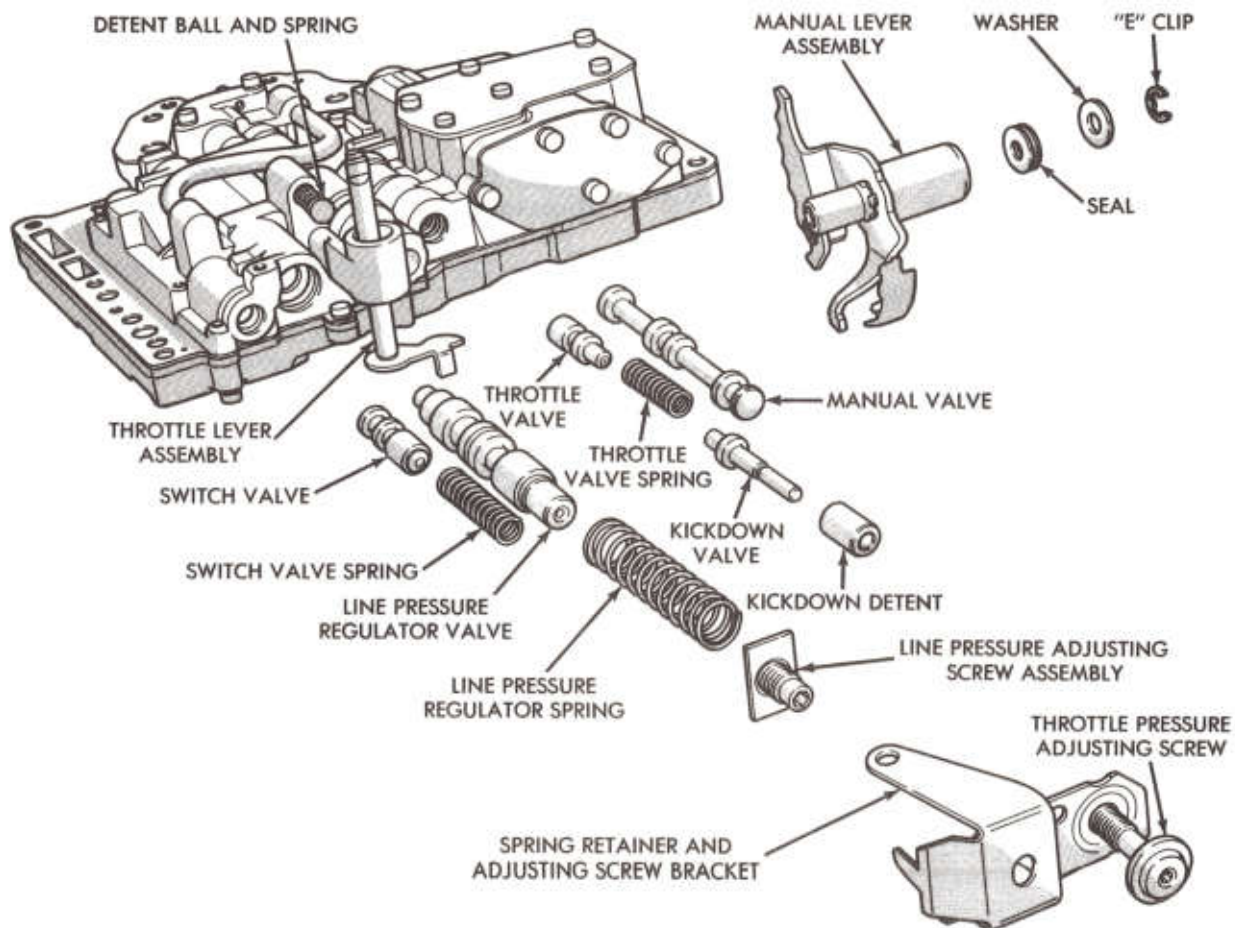


Fig. 2—Pressure Regulators and Manual Control

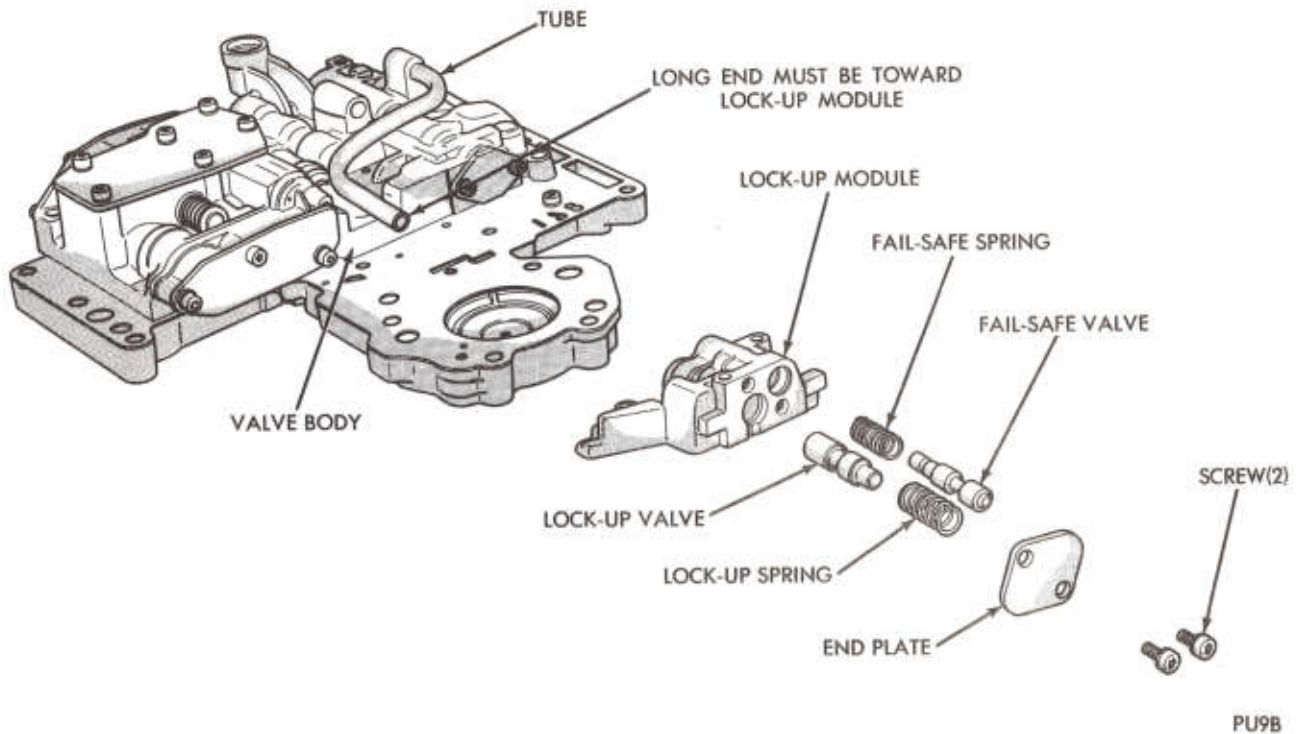


Fig. 3—Lockup Module

Manual Lever and Throttle Lever

(1) Remove E-clip and washer from throttle lever shaft (Fig. 2). Remove any burrs from shaft, then while holding manual lever detent ball and spring in their bore with Tool C-3765 or similar tool, slide manual lever off the throttle shaft. Remove the detent ball and spring.

(2) Slide manual valve out of its bore.

(3) Slide out the kickdown detent sleeve, kickdown valve, throttle valve spring, and the throttle valve.

Shift Valves and Regulator Valve Pressure Sensing Plugs

(1) Remove the line pressure regulator valve end plate (Fig. 7) and slide out the regulator valve sleeve, line pressure plug, throttle pressure plug, and spring.

(2) Remove the end plate and limit valve housing assembly.

(3) Remove throttle plug from housing.

(4) Slide retainer from housing and remove limit valve and spring.

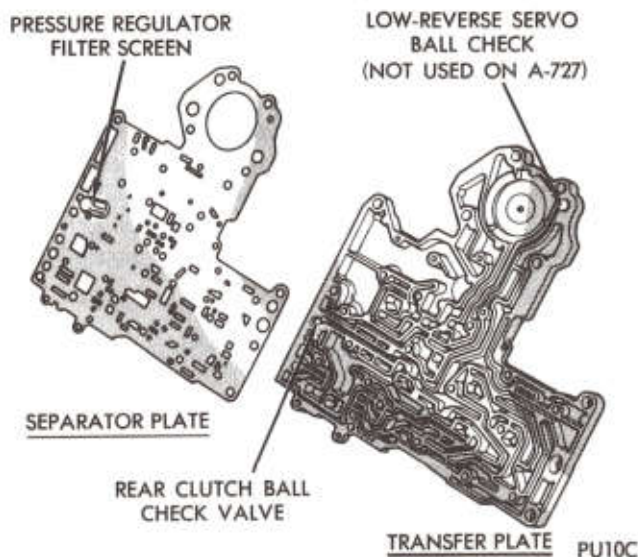


Fig. 4—Transfer Plate and Separator Plate

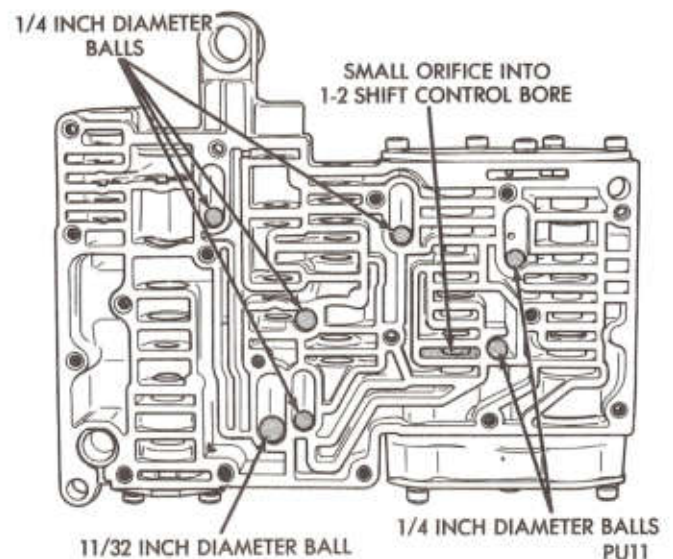
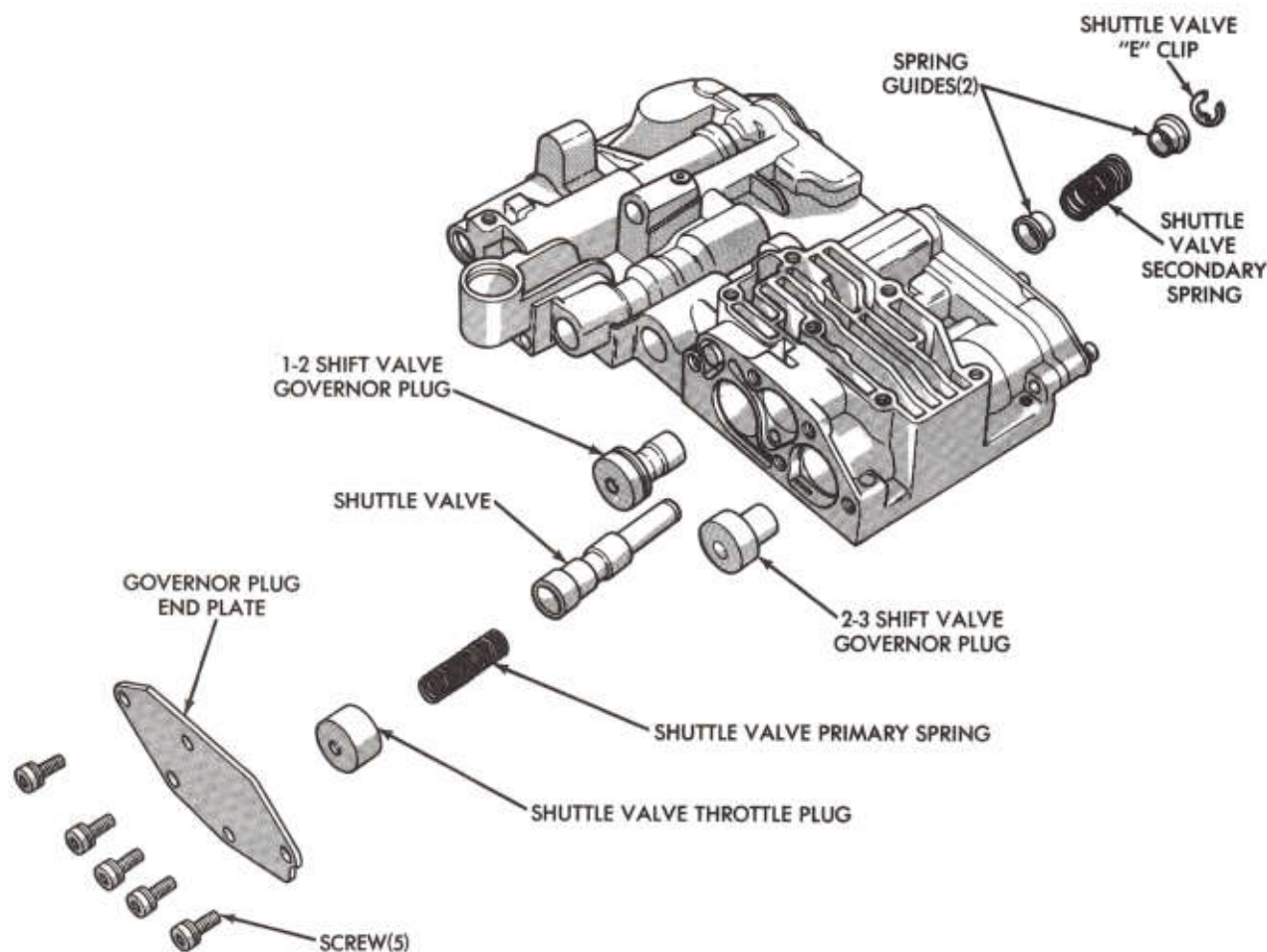


Fig. 5—Steel Ball Locations



PU12

Fig. 6—Shuttle Valve and Governor Plugs

(5) Remove the three springs and shift valves from the valve body.

Cleaning and Inspection

Allow all parts to soak a few minutes in a suitable, clean solvent. Wash thoroughly and blow dry with compressed air. Make sure all passages are clean and free from obstructions.

Inspect manual and throttle valve operating levers and shafts for being bent, worn or loose. If a lever is loose on its shaft, the lever and shaft assembly should be replaced. **Do not attempt to straighten bent levers.**

Inspect lockup solenoid assembly for cut or broken wire, melted or distorted coil, cut or nicked O-rings, etc. Shake solenoid to verify that plunger is free to travel. Replace solenoid if plunger is stuck. Check orifice in solenoid nozzle and drilled crosshole at solenoid bore in transfer plate for dirt or foreign material. To check solenoid operation, hold solenoid with nozzle pointing up and apply 12 volts between solenoid wire and solenoid frame at screw hole.

Plunger should travel up and down when 12 volts power is turned on and off.

Inspect all mating surfaces for burrs, nicks and scratches. Minor blemishes may be removed with crocus cloth, using only a very light pressure. Using a straightedge, inspect all mating surfaces for warpage or distortion. Slight distortion may be corrected, using a surface plate. Make sure all metering holes in steel plate and valve body are open. Using a pen light, inspect bores in valve body for scores, scratches, pits and irregularities.

Make sure orifice referred to in (Fig. 5) is open by inserting a 1/32 inch diameter drill through it into the 1-2 shift control valve bore.

Inspect all valve springs for distortion and collapsed coils. Inspect all valves and plugs for burrs, nicks, and scores. Small nicks and scores may be removed with crocus cloth, providing extreme care is taken not to round off sharp edges. The sharpness of these edges is vitally important because it prevents foreign matter from lodging between valve and valve body, thus

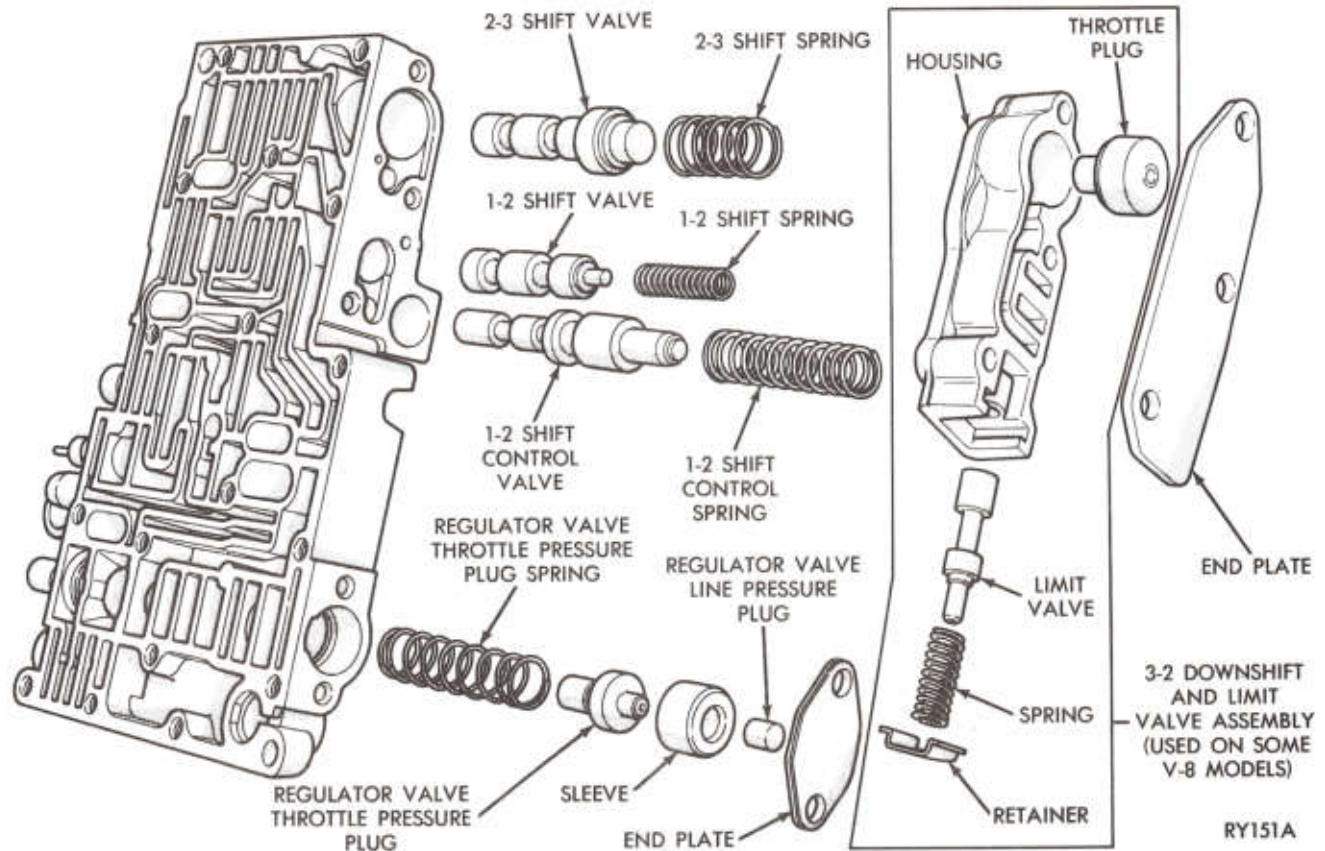


Fig. 7—Shift Valves and Pressure Regulator Valve Plugs

reducing possibility of sticking. Inspect all valves and plugs for freedom of operation in valve body bores.

When bores, valves, and plugs are clean and dry, the valves and plugs should fall freely in the bores. The valve body bores do not change dimensionally with use. Therefore, a valve body assembly that was functioning properly when vehicle was new, will operate correctly if it is properly and thoroughly cleaned. There is no need to replace valve body assembly unless it is damaged in handling.

VALVE BODY REASSEMBLY

(Tighten all valve body screws to 35 inch-pounds) (4 Newton-meters).

Shift Valves and Regulator Valve Pressure Sensing Plugs (Fig. 7)

(1) Slide shift valves and springs into proper valve body bores.
(2) Subassemble the 3-2 limit valve housing assembly as follows:

- (a) Insert limit valve and spring into housing.
- (b) Slide spring retainer into groove in housing.
- (c) Insert throttle plug in housing bore. Position assembly against the shift valve springs.

Omit step (2) when no 3-2 limit valve housing assembly is used.

(3) Install end plate and tighten screws.

(4) Install throttle pressure spring and plug, line pressure plug and sleeve, then fasten end plate to valve body.

Shuttle Valve and Governor Plugs (Fig. 6)

(1) Place 1-2 and 2-3 shift valve governor plugs in their respective bores.

(2) Install shuttle valve and hold it in bore with index finger while installing the secondary spring with guides and retaining E-clip.

(3) Install primary shuttle valve spring and throttle plug.

(4) Install governor plug end plate and tighten the retaining screws.

(5) Install shuttle valve cover plate and tighten the retaining screws.

Manual Lever and Throttle Lever (Fig. 2)

(1) Install throttle valve, throttle valve spring, kick-down valve, and kickdown detent sleeve.

(2) Slide manual valve into its bore.

(3) Install throttle lever and shaft on valve body. Insert detent spring and ball in its bore in valve body. Depress ball and spring with Tool C-3765 (Fig. 8) or similar tool and slide manual lever over throttle shaft so that it engages manual valve and detent ball. Install seal, retaining washer, and E-clip on throttle shaft.

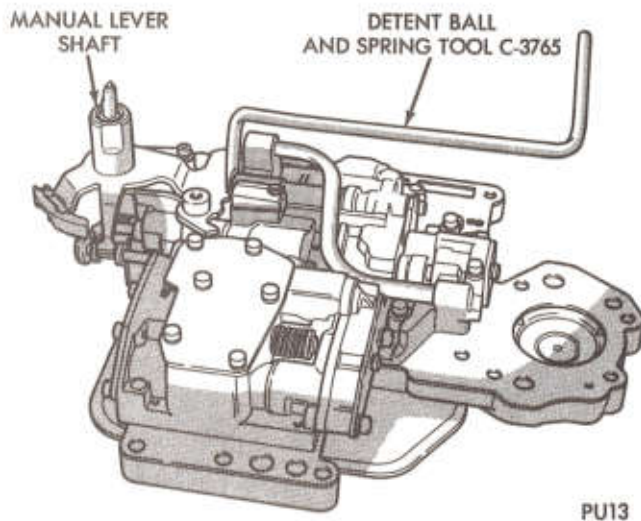


Fig. 8—Install Detent Spring and Ball

Filter, Transfer Plate, Lockup Solenoid, and Pressure Regulators

(1) Install the 7 balls in valve body as shown in Figure 5.

(2) Install rear clutch ball check and low-reverse servo ball check (Fig. 4) in transfer plate and regulator valve screen in separator plate (Fig. 4).

The low-reverse servo ball check is used ONLY with A-904T and A-999 transmissions.

(3) Install 3 screws in separator plate.

(4) Place transfer plate assembly on valve body. Be careful to align filter screen as the 17 shorter screws are installed finger tight (the three longer screws are for oil filter).

(5) Starting at the center and working outward, tighten screws to 35 in. lbs. (4 N·m).

(6) Slide switch valve and line pressure valves and springs into their bores (Fig. 2).

(7) Install pressure adjusting screw and bracket assembly on the springs and fasten with one screw for now. Use screw which goes into side of valve body. This screw is to be tightened first, after starting the top and bottom screws.

(8) Install oil filter and tighten screws to 35 in. lbs. (4 N·m).

(9) Install lockup valve and spring, then install fail-safe spring and valve into the lockup module (Fig. 3). Install lockup module to transfer and separator plate assembly with three screws. (Install stiffener plate on nonlockup valve body).

(10) Insert lockup solenoid nozzle (with O-ring) into bore in transfer plate and install retaining screw. Route lockup solenoid wire between solenoid and limit valve housing cover, and underneath edge of oil filter. **CAUTION: Correct wire routing is VERY IMPORTANT. The wire must be routed away from the low-reverse band lever.**

(11) After valve body has been serviced and completely assembled, measure throttle and line pressure adjustments (see "Maintenance and Adjustments"). However, if pressures were satisfactory prior to disassembly, use original settings.

(12) Install parking lock rod and E-clip retainer to manual lever.

VALVE BODY AND ACCUMULATOR PISTON INSTALLATION

(1) Make sure combination back-up lamp/neutral start switch is not installed in transmission case.

(2) Place valve body manual lever in "manual low" position to move parking rod to rear position.

(3) Use a screwdriver to push the park sprag into engagement with parking gear, turning output shaft to verify engagement. This will allow "knob" on end of parking rod to move past the sprag as valve body is installed.

(4) Install accumulator piston in the transmission case.

(5) Position accumulator spring between piston and valve body.

(6) Place valve body in position, working park rod through opening and past sprag. Install retaining bolts finger tight.

(7) With neutral starting switch installed, place manual lever in the "neutral" position. Shift valve body if necessary, to center neutral finger over the neutral switch plunger. Snug bolts down evenly, then tighten to 105 in. lbs. (12 N·m).

(8) Connect lockup solenoid wire to wiring connector pin at rear of transmission case, if so equipped.

(9) Install gearshift lever and tighten clamp bolt. Check lever shaft for binding in the case by moving lever through all detent positions. If binding exists, loosen valve body bolts and realign.

(10) Make sure throttle shaft seal is in place, then install flat washer and throttle lever and tighten the clamp bolt. Connect throttle and gearshift linkage and adjust as required.

(11) Install oil pan, with a new gasket. Add transmission fluid to bring it up to proper level.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils, or equivalent. Essentially, this repair consists of drilling out the worn or damaged threads, tapping the hole with a special Heli-Coil tap, or equivalent, and installing a Heli-Coil insert, or equivalent into the tapped hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

SERVICE OUT OF VEHICLE

INDEX

	Page		Page
Assembly-Subassembly Installation	95	Oil Pump and Reaction Shaft Support—	
Disassembly-Subassembly Removal	77	A-904T/A-999	79
Installation—Transmission, Torque Converter and		Oil Pump and Reaction Shaft Support—A-727 .	81
Drive Plate	98	Overrunning Clutch	93
Pump Oil Seal	76	Planetary Gear Train—A-904T/A-999	90
Recondition Subassemblies	79	Planetary Gear Train—A-727	91
Front Clutch—A-904T/A-999	83	Rear Clutch—A-904T/A-999	87
Front Clutch—A-727	85	Rear Clutch—A-727	89
Kickdown Servo and Band	94	Removal—Transmission and Torque Converter .	75
Low-Reverse Servo and Band	95	Specifications	117
		Tightening Reference	119

TRANSMISSION AND CONVERTER REMOVAL

Remove Transfer Case (if so equipped). Refer to "Transfer Case Removal" for procedure.

(1) The transmission and torque converter must be removed as an assembly; otherwise, the torque converter drive plate, pump bushing, or oil seal may be damaged. The drive plate will not support a load; therefore, none of the weight of the transmission should be allowed to rest on the plate during removal.

(2) Disconnect negative (ground) cable from the battery for safety.

(3) Some models require that the exhaust system be dropped for clearance, (see Group 11).

(4) Remove engine to transmission struts, if so equipped.

(5) Remove cooler lines at Transmission.

(6) Remove starter motor and cooler line bracket.

(7) Remove torque converter access cover.

(8) Loosen oil pan bolts, tap the pan to break it loose allowing fluid to drain.

(9) Reinstall pan.

(10) Mark torque converter and drive plate to aid in reassembly. The crankshaft flange bolt circle, inner and outer circle of holes in the drive plate, and the four tapped holes in front face of the torque converter all have one hole offset so these parts will be installed in the original position. This maintains balance of the engine and torque converter.

(11) Rotate engine clockwise with socket wrench on vibration dampener bolt to position the bolts attaching torque converter to drive plate, and remove bolts.

(12) Mark parts for reassembly then disconnect propeller shaft at rear universal joint. Carefully pull shaft assembly out of the extension housing.

(13) Disconnect wire connector from the back-up lamp and neutral starting switch and lockup solenoid wiring connector, if so equipped.

(14) Disconnect gearshift rod and torque shaft assembly from transmission.

When it is necessary to disassemble linkage rods from levers that use plastic grommets as retainers,

the grommets should be replaced with new ones. Use a prying tool to force rod from grommet in lever, then cut away old grommet. Use pliers to snap new grommet into lever and rod into grommet.

(15) Disconnect throttle rod from lever at the left side of transmission. Remove linkage bellcrank from transmission, if so equipped.

(16) Remove oil filler tube and speedometer cable.

(17) Install engine support fixture, Tool C-3487-A with frame hooks or a suitable substitute, that will support rear of the engine (Fig. 1).

(18) Raise transmission slightly with service jack to relieve load on the supports.

(19) Remove bolts securing transmission mount to crossmember and crossmember to frame, then remove crossmember.

(20) Remove all bell housing bolts.

(21) Carefully work transmission and torque converter assembly rearward off engine block dowels and disengage torque converter hub from end of crankshaft. **Attach a small C-clamp to edge of bell housing to hold torque converter in place during transmission removal.**

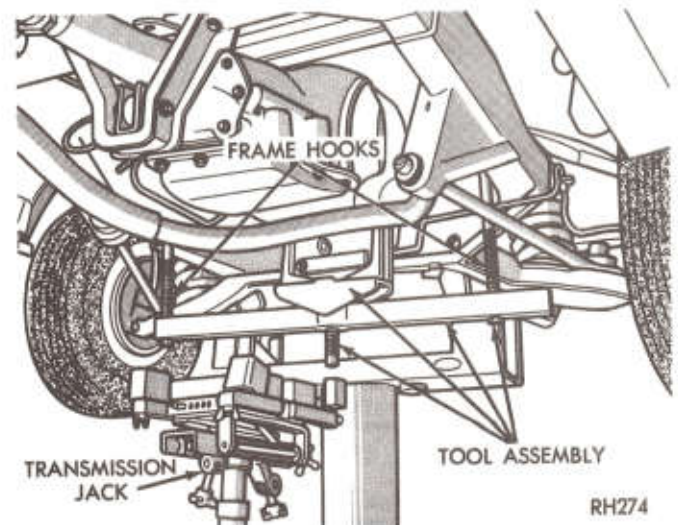


Fig. 1—Engine Support Fixture (Typical)

(22) Lower transmission and remove assembly from under the vehicle.

(23) To remove torque converter assembly; remove C-clamp from edge of bell housing, then carefully slide assembly out of the transmission.

STARTER RING GEAR REPLACEMENT

NOTE 1: All lockup torque converters, with starter ring gears that require replacement, **should be replaced** with a torque converter assembly. This is to prevent lockup friction material damage while welding new ring gear in place.

NOTE 2: All nonlockup torque converters, with starter ring gears that require replacement can have the gear changed as per instructions below.

The starter ring gear is mounted directly on outer diameter of the torque converter front cover. With torque converter removed from vehicle, replacement of the gear is as follows:

Removal

(1) Cut through weld material at rear side of ring gear with a hack saw or grinding wheel (Fig. 2). Be careful not to cut or grind into front cover stamping.

(2) Scribe a heavy line on the front cover next to front face of ring gear to aid in locating the new gear.

(3) Support torque converter on front cover, next to the lugs with blocks of wood to prevent altering lug position. The torque converter must **not** rest on the front cover hub during this operation. Using a blunt chisel, or drift and hammer, tap downward on ring gear near welded areas to break any remaining weld material (Fig. 2). Tap around ring gear until it comes off the torque converter.

(4) Smooth off weld areas on the cover with a file.

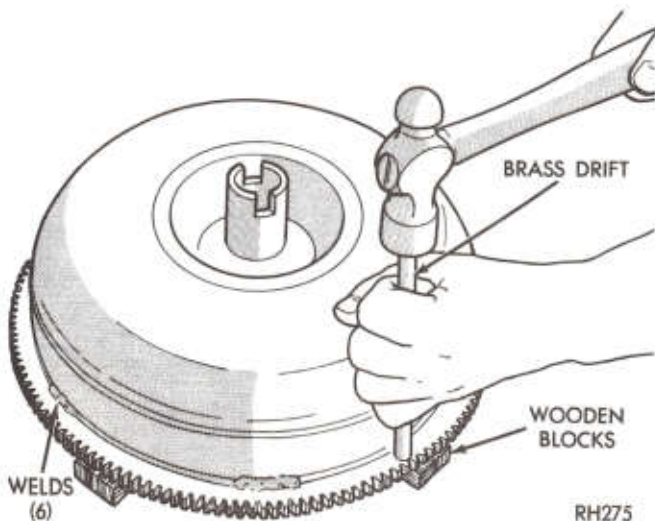


Fig. 2—Remove Starter Ring Gear (Nonlockup Only)

Installation

Any of the following methods may be used to heat and expand starter ring gear for installation on the torque converter:

Oven: Place ring gear in Oven and set temperature at 200 degrees F. (93 degrees Celsius). Allow ring gear to remain in oven for 15 to 20 minutes.

Boiling Water: Place ring gear in a shallow container, add water, and heat for approximately eight minutes after water has come to a boil.

Steam: Place ring gear on a flat surface and direct flow around gear for approximately two minutes.

Flame: Place ring gear squarely on a flat surface. Using a medium-size tip, direct a slow flame evenly around inner rim of the gear. **Do not apply flame to the gear teeth.** Place a few drops of water on face of gear at intervals during heating process. When gear is hot enough to just boil the water, installation of gear on the torque converter can be made.

(1) After ring gear is expanded by heating, place the gear in position on torque converter front cover. Tap gear on the cover evenly with a plastic or rawhide mallet until face of gear is even with scribed line (made during removal) on the front cover. Make sure gear is even with scribed line around full circumference of the front cover.

(2) Reweld ring gear to torque converter front cover, being careful to place, as nearly as possible, same amount of weld material in exactly same location as was used in original weld. This is necessary in order to maintain proper balance of the unit. Place welds alternately on opposite sides of torque converter to minimize distortion.

(3) The following suggestions are offered as an aid in making the weld:

- Do not gas weld.**
- Use a D.C. welder that is set at straight polarity or an A.C. welder if the proper electrode is available.
- Use a 1/8 inch diameter welding rod, and a welding current of 80 to 125 amps.
- Direct the arc at intersection of the gear and front cover from an angle of 45 degrees from rear face of the gear.

(4) Inspect gear teeth and remove all nicks where metal is raised, weld metal splatter, etc., in order to insure quiet starter operation.

OIL COOLER AND TUBES FLUSHING (See "Diagnosis and Tests")

PUMP OIL SEAL

Replacement

The pump oil seal can be replaced without removing

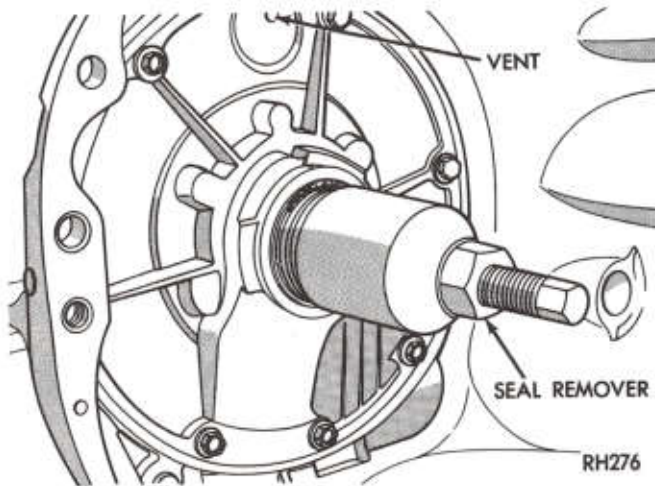


Fig. 3—Remove Pump Seal

pump and reaction shaft support assembly from the transmission case.

(1) **A-904T and A-999:** Screw seal remover Tool C-3981 into seal (Fig. 3), then tighten screw portion of tool to withdraw the seal.

A-727: Using Tool C-3861, remove seal in the same manner.

(2) **A-904T and A-999:** To install a new seal, place seal in opening of the pump housing (lip side facing inward). Using Tool C-4193 and handle Tool C-4171, drive seal into housing until tool bottoms (Fig. 4).

A-727: Using Tool C-3860-A and handle Tool C-4171, install new seal in the same manner.

DISASSEMBLY—SUBASSEMBLY REMOVAL

Prior to removing any transmission subassemblies, plug all openings and thoroughly clean exterior of the unit, preferably by steam. Cleanliness through entire disassembly and assembly cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not**

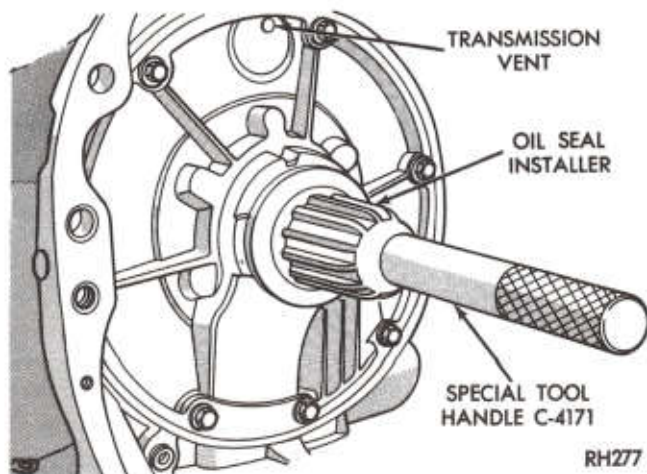


Fig. 4—Install Pump Seal

wipe parts with shop towels. All mating surfaces in the transmission are accurately machined; therefore, careful handling of parts must be exercised to avoid nicks or burrs.

Input Shaft End Play

Measuring input shaft end play before disassembly will usually indicate when a thrust washer change is required, (except when major parts are replaced). The thrust washer is located between reaction shaft support and front clutch retainer on A-727 transmissions. The thrust washer is located between input and output shafts on A-904T and A-999 transmissions.

(1) Attach a dial indicator to transmission bell housing with its plunger seated against end of input shaft (Fig. 5).

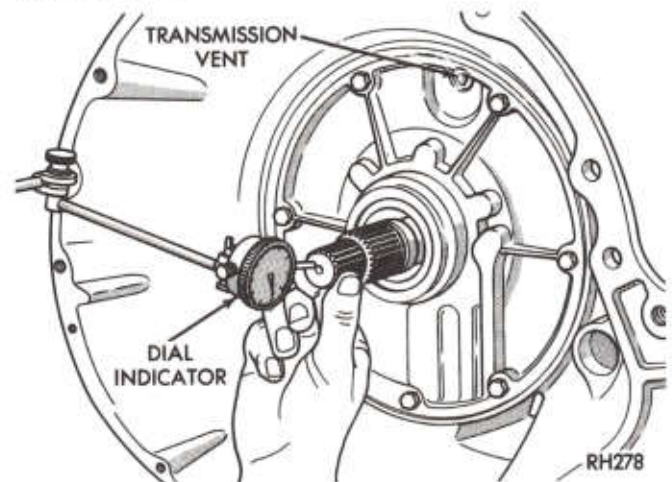


Fig. 5—Measuring Input Shaft End Play

Move input shaft in and out to obtain end play reading. End play specifications are .022 to .091 inch for A-904T and A-999 transmission, and .034 to .084 inch for A-727 transmissions.

(2) Record indicator reading for reference when reassembling the transmission.

Oil Pan

(1) Place transmission assembly in repair stand, Tool C-3750-A (Fig. 6).

(2) Remove oil pan bolts and remove oil pan and gasket.

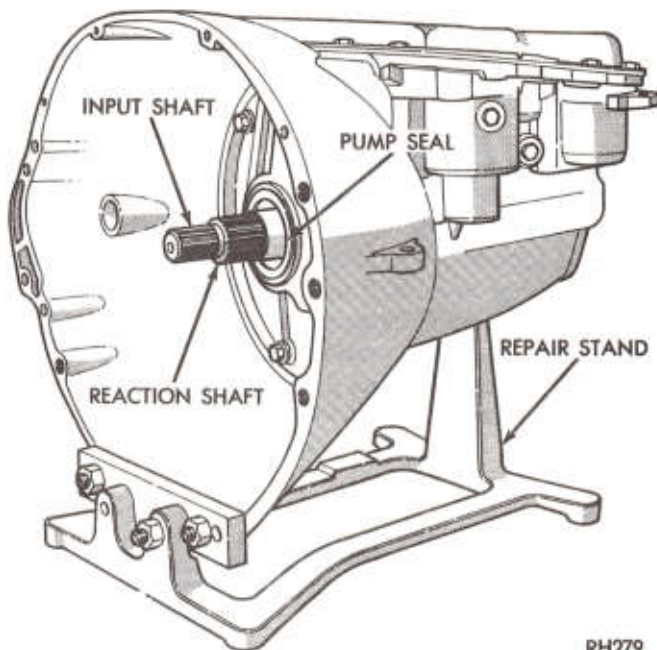
Valve Body Assembly

(1) Loosen clamp bolts and remove throttle and gearshift levers from the transmission.

(2) Remove back-up lamp/neutral start switch.

(3) Disconnect lockup solenoid wire from wiring connector at rear of transmission case, if so equipped.

(4) Remove the 10 hex-head valve body to transmission bolts. Remove E-clip securing parking lock rod to the valve body manual lever.



RH279

Fig. 6—Transmission in Repair Stand

(5) While lifting valve body upward out of transmission case, disconnect parking lock rod from the lever.

Accumulator Piston and Spring

(1) Lift spring off accumulator piston and withdraw piston from the case.

Extension Housing (or Adapter on 4WD)

Before removing extension housing, pull parking lock rod forward out of the case. Rotate output shaft, if necessary, to align parking gear and sprag to permit knob on end of control rod to pass the sprag.

(1) Remove speedometer pinion and adapter assembly.

(2) Remove extension housing to transmission bolts.

(3) Remove screws, plate, and gasket from bottom of extension housing mounting pad. Spread large snap ring from output shaft bearing. With snap ring spread as far as possible, carefully tap extension housing off the output shaft and bearing.

(4) Using heavy-duty snap ring pliers, remove output shaft bearing rear snap ring. Remove bearing from shaft, then remove front snap ring (A-727). The A-904T and A-999 transmissions have no front snap ring.

(5) On 4WD vehicles, use Tool L-4450 inverted with Handle C-4171 to drive out bearing from adapter, if necessary.

Governor and Support

(1) Carefully pry snap ring from weight end of governor valve shaft. Slide valve and shaft assembly out of the governor body.

(2) Remove snap ring from behind governor body,

then slide governor body and support assembly off the output shaft.

Oil Pump and Reaction Shaft Support

(1) Tighten front band adjusting screw until band is tight on front clutch retainer. This prevents clutch retainer from coming out with pump which might cause unnecessary damage to the clutches.

(2) Remove oil pump housing retaining bolts.

(3) Attach Tool C-3752 to pump housing flange, (Fig. 7), in threaded holes in the flange.

(4) Bump outward evenly with the two "knocker weights" to withdraw oil pump and reaction shaft support assembly from the case.

Front Band and Front Clutch

(1) Loosen front band adjuster, remove band strut (and A-727 anchor) and slide band out of the case.

(2) Slide front clutch assembly out of the case.

Input Shaft and Rear Clutch

(1) Grasp input shaft, and slide input shaft and rear clutch assembly out of the case.

Be careful not to lose thrust washer located between rear end of input shaft and forward end of the output shaft.

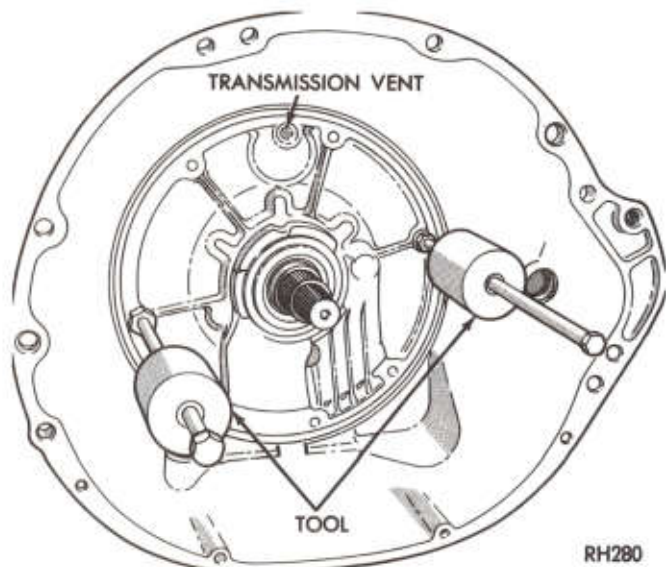
Planetary Gear Assemblies, Sun Gear, and Driving Shell

(1) While supporting output shaft and driving shell, carefully slide assembly forward and out through the case.

Be very careful not to damage ground surfaces on output shaft during removal.

Rear Band and Low-Reverse Drum

(1) Remove low-reverse drum, loosen rear band



RH280

Fig. 7—Remove Oil Pump

adjuster, remove band strut and link, remove band from the case.

(Double-Wrap Band): Loosen band adjusting screw, then remove band and low-reverse drum.

Overrunning Clutch

(1) Note position of overrunning clutch rollers and springs before disassembly, to assist in reassembly.

(2) Carefully slide out clutch hub and remove rollers and springs.

Kickdown Servo (Front)

(1) Compress kickdown servo spring by using engine valve spring compressor Tool C-3422A, remove snap ring (Fig. 8).

(2) Remove rod guide, spring and piston assembly from the case. Be careful not to damage piston rod or guide during removal.

(3) Withdraw piston from the transmission case.

Low-Reverse Servo (Rear)

(1) Compress low and reverse servo piston spring by using engine valve spring compressor Tool C-3422A, then remove the snap ring.

(2) Remove spring retainer, spring, and servo piston and plug assembly from the case.

RECONDITION SUBASSEMBLIES

The following procedures cover disassembly, inspection, repair, and assembly of each subassembly as removed from the transmission.

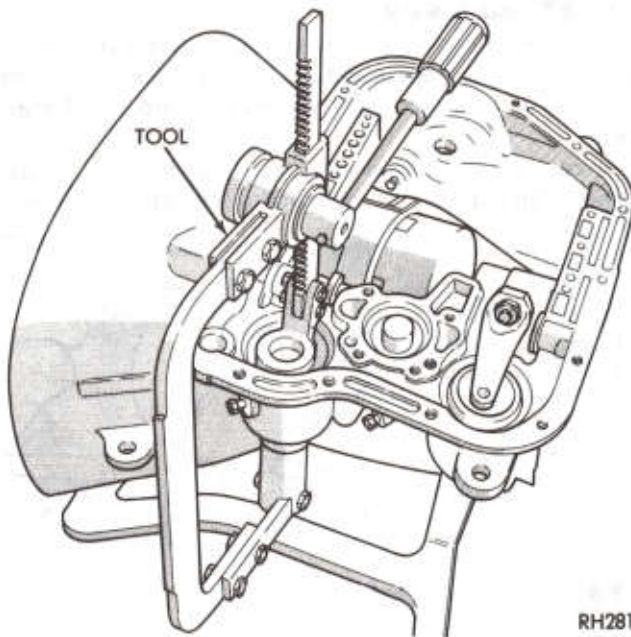


Fig. 8—Compress Kickdown Servo Spring

Heli-Coil inserts are recommended for repairing damaged, stripped or worn threads in aluminum parts.

Presized service bushings are available for replacement for most all bushings in the LoadFlite transmissions. The two bushings in sun gear are not serviced because of the low cost of sun gear assembly. If bushings are found worn or scored, they should be replaced as outlined in the following reconditioning procedures.

The bushing replacement tools listed by "SP" numbers are part of Tool Kit C-3887B.

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on valves, use extreme care to avoid rounding off the sharp edges. The sharp edge is vitally important to this type of valve. Sharp edges prevent dirt and foreign matter from getting between the valve and body, thus reducing possibility of sticking. When it becomes necessary to recondition transmission, and vehicle has accumulated considerable mileage, install new seal rings on parts requiring their usage. Coat each part with automatic transmission fluid during assembly.

OIL PUMP AND REACTION SHAFT SUPPORT—A-904T and A-999

Due to the lockup torque converter, it is important that the oil pump be within the clearance limits as specified. Also note that the oil pump bushing should be replaced in any overhaul.

Disassembly

Figure 9 shows the oil pump and reaction shaft support disassembled.

(1) Remove bolts from rear side of reaction shaft support and lift support off the pump.

(2) Remove rubber seal ring from pump body flange.

(3) Drive out oil seal with a blunt punch.

Inspection

Inspect interlocking seal rings (Fig. 9) on reaction shaft support for wear or broken locks, make sure they turn freely in the grooves. Seal rings have to be removed to allow clearance for #1 thrust washer removal or installation. Inspect front clutch piston retainer to reaction shaft support thrust washer for wear. Washer thickness should be .061 to .063 inch, replace if necessary. Inspect machined surfaces on pump body and reaction shaft support for nicks and burrs. Inspect pump body and reaction shaft support bushings for wear or scores. Inspect pump gears for scoring or pitting. With gears cleaned and installed in pump body, place a straightedge across face of gears

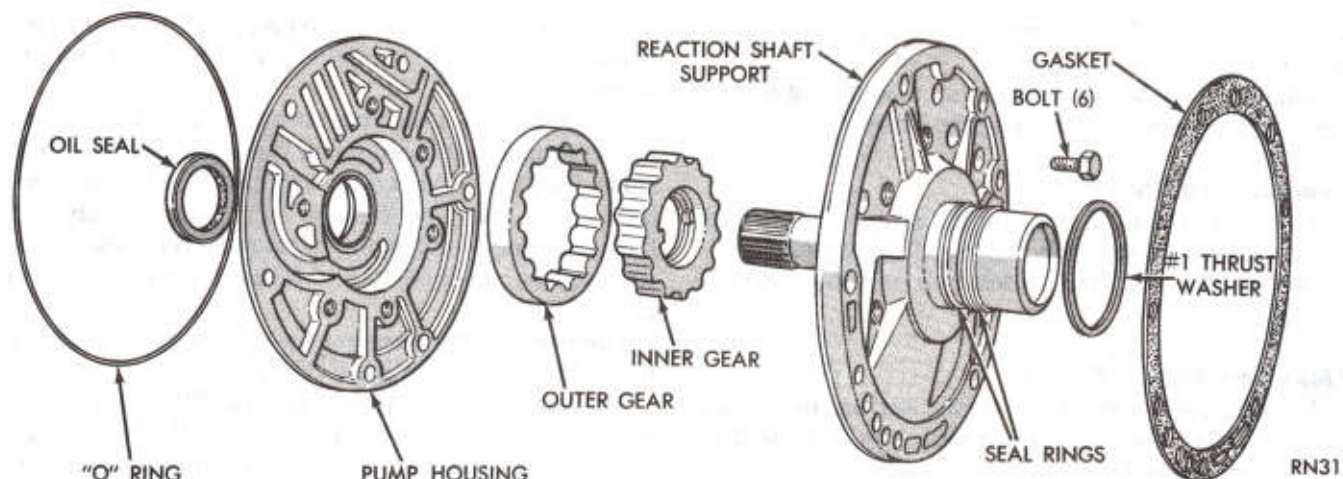


Fig. 9—Oil Pump and Reaction Shaft Support (A-904T and A-999)

and pump body. Use a feeler gauge to measure clearance between straightedge and face of gears. Clearance limits are from .001 to .0025 inch. Clearance between outer gear and its bore in oil pump body should be .0035 to .0075 inch.

Pump Bushing Replacement—A-904T and A-999

(1) Place pump housing (seal face down) on a smooth firm surface.

(2) Place removing head, Tool SP-3551 in bushing and install handle Tool C-4171 in the removing head (Fig. 10).

(3) Drive bushing straight down and out of pump housing bore. Be careful not to cock tool in the bore.

(4) Position new bushing on installing head Tool SP-5117.

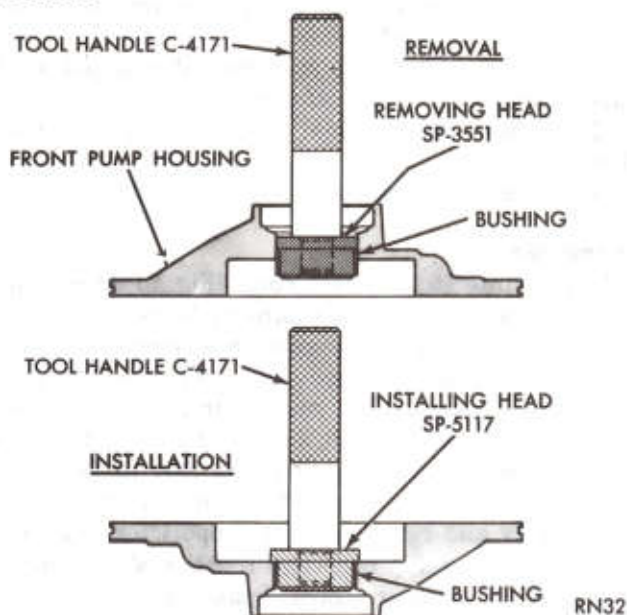


Fig. 10—Replace Pump Bushing (A-904T and A-999)

(5) With pump housing on a smooth, clean surface, start bushing and installing head in the bushing bore. Install handle in the installing head (Fig. 10).

(6) Drive bushing into housing until tool bottoms in the pump cavity. Be careful not to cock tool during installation.

(7) Stake bushing in place by using a blunt punch or similar tool (Fig. 11). A gentle tap at each stake slot location will suffice.

(8) Using a narrow-bladed knife or similar tool, remove high points or burrs around staked area (Fig. 11). Do not use a file or similar tool that will remove more metal than is necessary.

Reaction Shaft Bushing Replacement—A-904T and A-999

For identification purposes, **lockup** reaction shaft support has **3 steel balls** in the support at outside diameter of reaction shaft and **nonlockup** has **2 steel balls**.

In case of a reaction shaft bushing failure, always inspect the support for wear from the input shaft seal

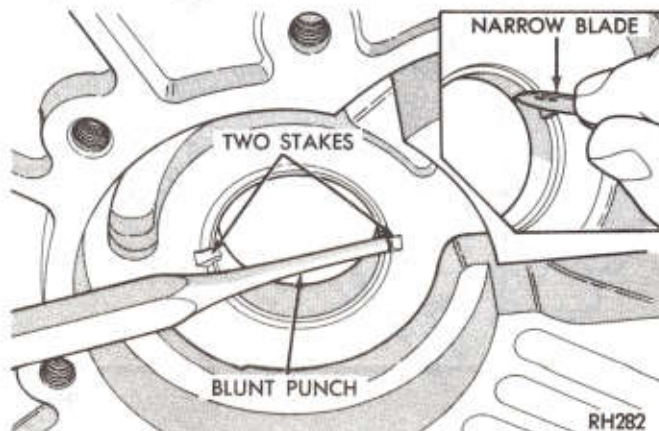


Fig. 11—Stake Pump Bushing (A-904T and A-999)

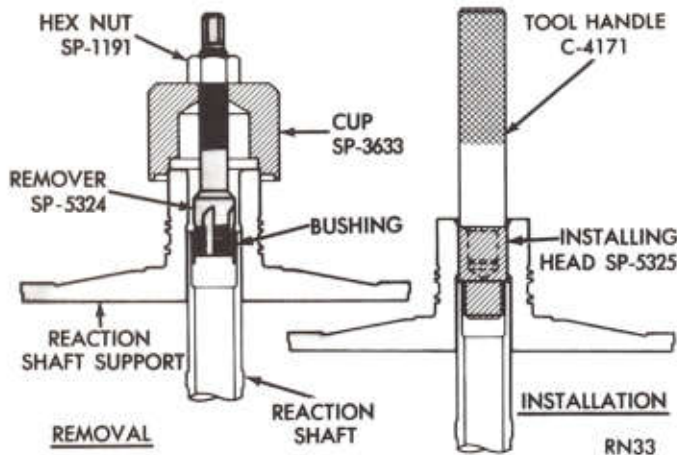


Fig. 12—Replacing Reaction Shaft Bushing (A-904T and A-999)

ring lands. If worn or grooved, replace support assembly.

(1) Assemble the remover Tool SP-5324, cup Tool SP-3633, and hex-nut Tool SP-1191 (Fig. 12).

Do not clamp any part of reaction shaft or support in a vise.

(2) With cup held firmly against reaction shaft, thread remover into bushing as far as possible by hand.

(3) Using a wrench, screw remover into bushing 3 to 4 additional turns to firmly engage threads in the bushing.

(4) Turn hex nut down against cup to pull bushing from reaction shaft. Thoroughly clean reaction shaft to remove chips made by remover threads.

(5) Lightly grip bushing in a vise or with pliers and back tool out of the bushing. Be careful not to damage threads on bushing remover.

(6) Slide a new bushing on installing head Tool SP-5325, and start them in the bore of reaction shaft (Fig. 12).

(7) Support reaction shaft upright on a clean, smooth surface and install handle C-4171 in installing head. Drive bushing into the shaft until tool bottoms.

(8) Thoroughly clean reaction shaft support assembly before installation.

Assembly

(1) Place reaction shaft support in assembling Tool C-3759, with hub of support and tool resting on a smooth, flat surface bench (Fig. 13). Screw two pilot studs Tool C-3283A into threaded holes of reaction shaft support flange.

(2) Assemble and place pump gears in center of the support.

(3) Lower pump body over the pilot studs, insert Tool C-3756 through pump body and engage pump inner gear. Rotate the pump gears with tool to center gears in pump body, then with pump body firm against reaction shaft support, tighten clamping tool

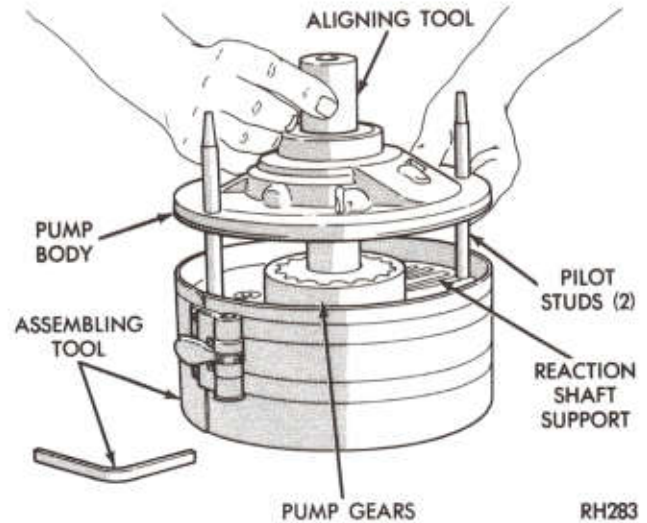


Fig. 13—Assemble Pump and Reaction Shaft Support (A-904T and A-999)

securely.

(4) Invert pump and reaction shaft support assembly with clamping tool intact. Install support to pump body bolts and tighten to 175 in. lbs. (20 N·m). Remove clamping tool, pilot studs, and gear alignment tool.

(5) Place a new oil seal in opening of pump housing (lip of seal facing inward). Using Tool C-4193 and handle Tool C-4171, drive seal into housing until tool bottoms.

OIL PUMP AND REACTION SHAFT SUPPORT—A-727

It is important that the oil pump be within the clearance limits as specified. Also note that the oil pump bushing should be replaced in any overhaul.

Disassembly

Figure 14 shows the oil pump and reaction shaft support disassembled.

(1) Remove bolts from rear side of reaction shaft support, and lift support off the pump.

(2) Remove rubber seal ring from pump body flange.

(3) Drive out oil seal with a blunt punch.

Inspection

Inspect interlocking seal rings (Fig. 14) on reaction shaft support for wear or broken locks, make sure they turn freely in the grooves. Inspect machined surfaces on pump body and reaction shaft support for nicks and burrs. Inspect pump body and reaction shaft support bushings for wear or scores. Inspect pump gears for scoring or pitting. With gears cleaned and installed in pump body, place a straightedge across face of gears and pump body. Use a feeler gauge to measure clearance between straightedge and face of

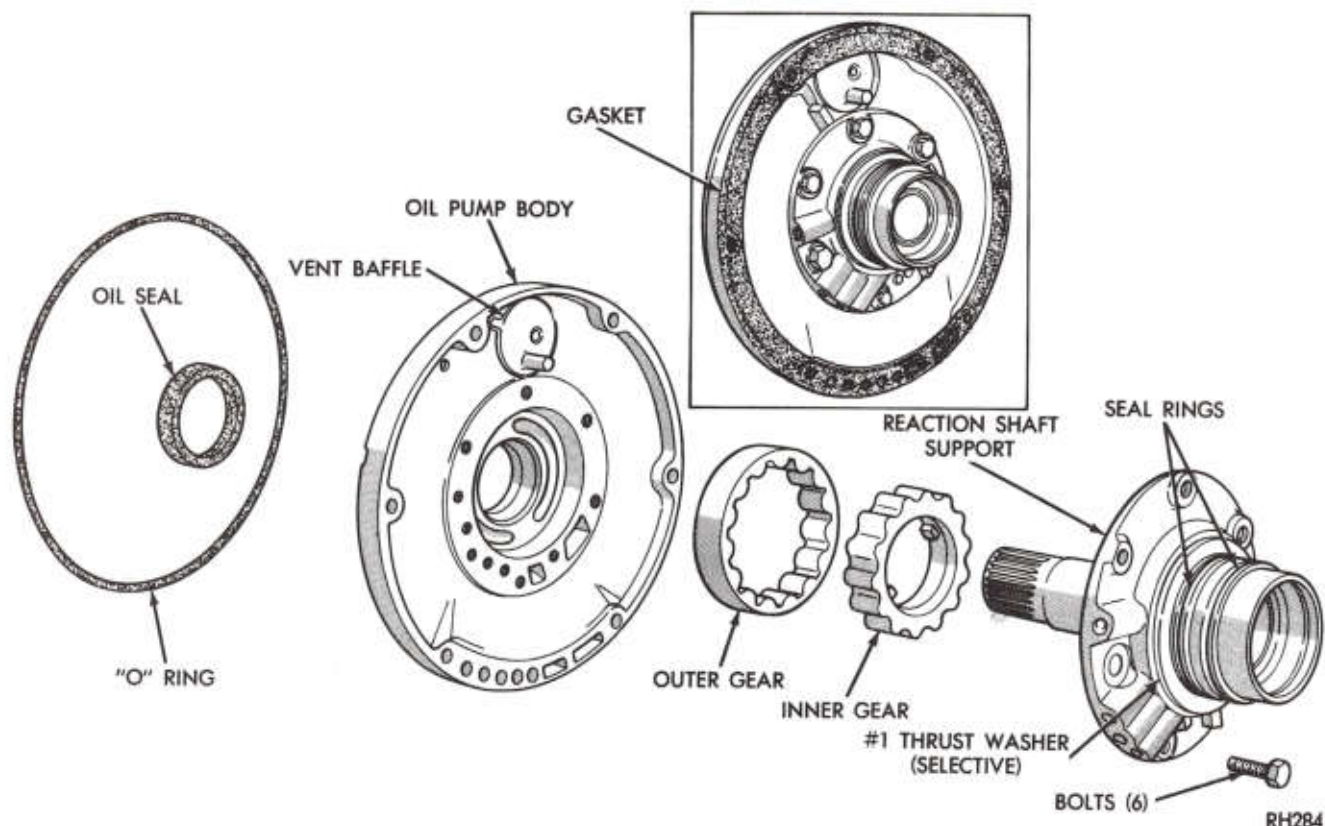


Fig. 14—Oil Pump and Reaction Shaft Support (A-727)

gears. Clearance limits are from .001 to .0025 inch. Clearance between outer gear and its bore in oil pump body should be .004 to .008 inch.

Pump Bushing Replacement—A-727

- (1) Place pump housing on a clean, smooth surface

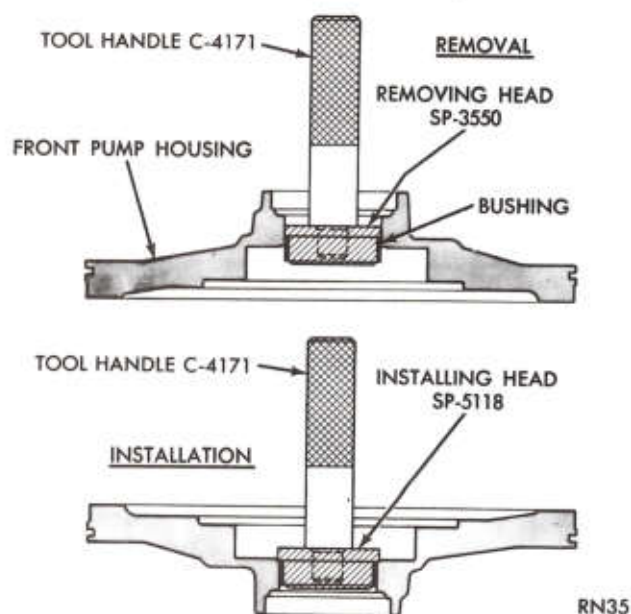


Fig. 15—Replacing Pump Bushing (A-727)

with gear cavity down.

- (2) Place removing head Tool SP-3550 in bushing, and install handle Tool C-4171 in the removing head (Fig. 15).

- (3) Drive bushing straight down and out of the bore. Be careful not to cock tool in the bore.

- (4) Position a new bushing on installing head Tool SP-5118.

- (5) With pump housing on a smooth, clean surface (hub end down), start bushing and installing head in the bushing bore. Install handle in installing head.

- (6) Drive bushing into housing until tool bottoms in the pump cavity. Be careful not to cock tool during installation.

- (7) Stake the bushing in place by using a blunt punch or similar tool (Fig. 16). A gentle tap at each stake slot location will suffice.

- (8) Using a narrow-bladed knife or similar tool, remove high points or burrs around staked area. Do not use a file or similar tool that will remove more metal than is necessary.

- (9) Thoroughly clean pump housing before installation.

Reaction Shaft Bushing Replacement—A-727

- (1) Assemble the remover Tool SP-5301, cup Tool SP-3633, and hex-nut Tool SP-1191 (Fig. 17).

Do not clamp any part of reaction shaft or support

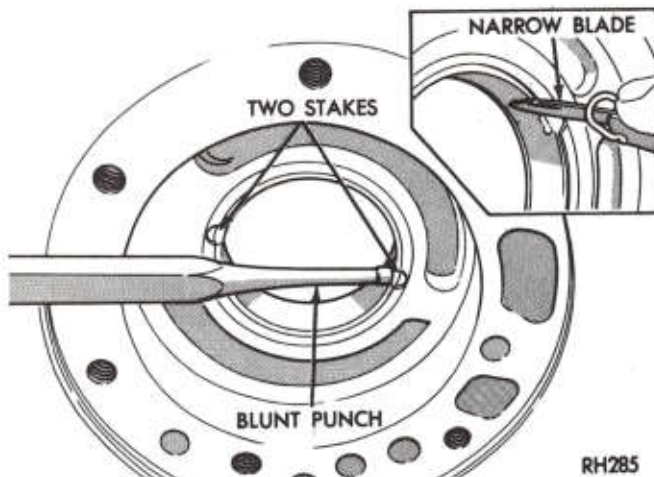


Fig. 16—Stake Pump Bushing (A-727)

in a vise.

(2) With cup held firmly against reaction shaft, thread remover into bushing as far as possible by hand.

(3) Use a wrench to screw remover into bushing 3 to 4 additional turns to firmly engage threads in the bushing.

(4) Turn hex nut down against the cup to pull bushing from reaction shaft. Thoroughly clean reaction shaft to remove chips made by remover threads.

(5) Lightly grip bushing in a vise or with pliers and back tool out of the bushing. Be careful not to damage threads on bushing remover.

(6) Slide a new bushing (chamfered end first) on installing head Tool SP-5302, and start them in the bore of reaction shaft (Fig. 17).

(7) Support reaction shaft upright on a clean, smooth surface and install handle Tool C-4171 in installing head. Drive bushing into shaft until tool bottoms.

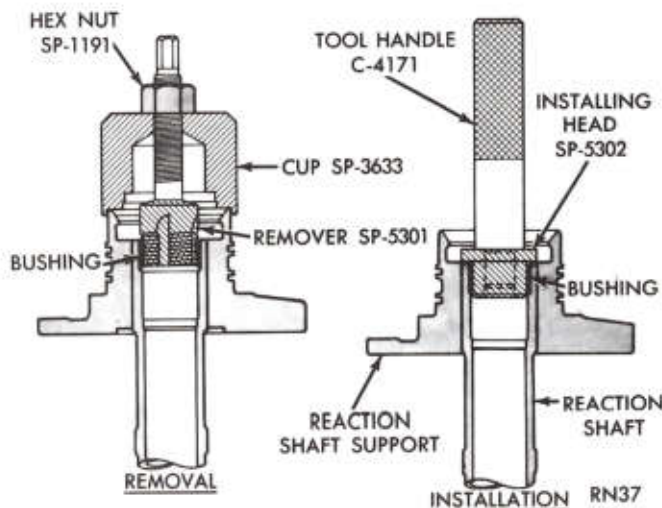


Fig. 17—Replacing Reaction Shaft Bushing (A-727)

(8) Thoroughly clean the reaction shaft support assembly before installation.

Assembly

(1) Assemble pump gears and O-ring in the pump housing (Fig. 14).

(2) Install reaction shaft support. Install retaining bolts and tighten to 175 in. lbs. (20 N·m).

(3) Place a new oil seal in opening of pump housing (lip of seal facing inward) using Tool C-3860A and Handle C-4171, drive seal into housing until tool bottoms.

FRONT CLUTCH—A-904T and A-999

Disassembly

Figure 18 shows a disassembled view of the front clutch assembly.

(1) Remove large waved snap ring that secures pressure plate in the clutch piston retainer. Lift pressure plate and clutch plates out of the retainer.

(2) Install compressor Tool C-3575A, over piston spring retainer (Fig. 19). Compress spring and remove snap ring, then slowly release tool until spring retainer is free of the hub. Remove tool, retainer, and spring.

(3) Invert clutch retainer assembly and bump it on a wooden block to remove the piston. Remove seals from the piston and clutch retainer hub.

Inspection

Inspect plates and discs for flatness. They must not be warped or cone shaped.

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces; plates must travel freely in grooves. Inspect band contacting surface on clutch retainer for scores, the contact surface should be protected from damage during disassembly and handling. Note ball check in clutch retainer, make sure ball moves freely. Inspect piston seal surfaces in clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing of seals. Inspect clutch retainer inner bore surface for wear from reaction shaft support seal rings. Inspect clutch retainer bushing for wear or scores.

Inspect inside bore of piston for score marks, if light, remove with crocus cloth. Inspect seal grooves for nicks and burrs. Inspect seals for deterioration,

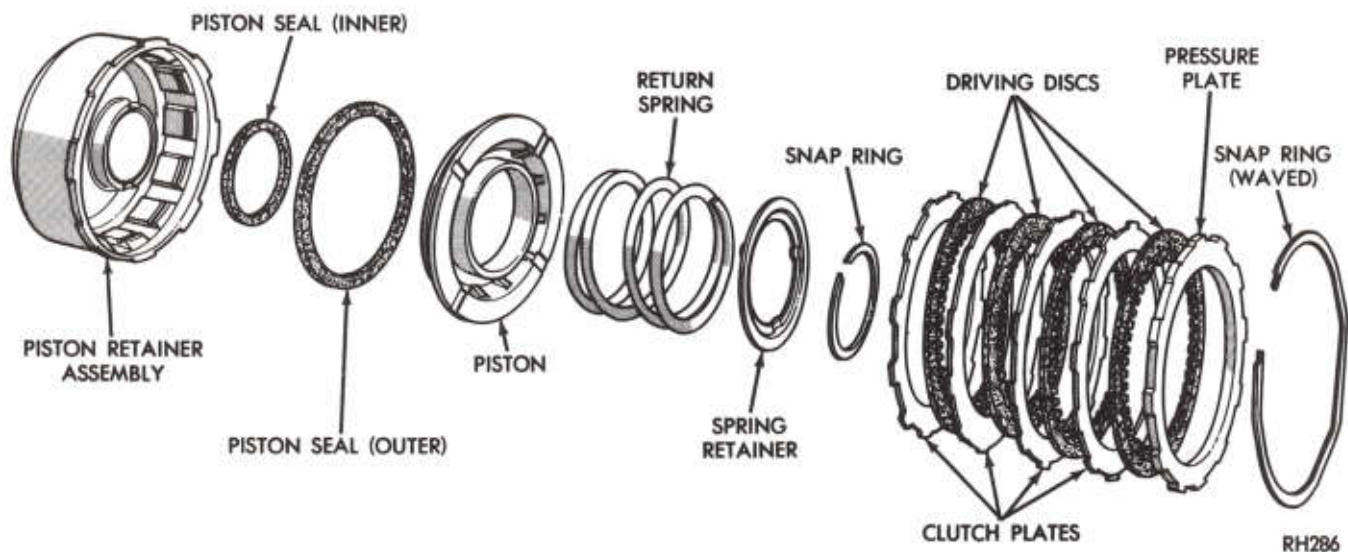


Fig. 18—Front Clutch (A-904T and A-999)

wear, and hardness. Inspect piston spring, retainer and snap ring for distortion.

Front Clutch Retainer Bushing Replacement—A-904T and A-999

(1) Lay clutch retainer (open end down) on a clean, smooth surface and place removing head Tool SP-3627 in the bushing (Fig. 20). Install handle Tool C-4171 in removing head.

(2) Drive bushing straight down and out of clutch retainer bore. Be careful not to cock tool in the bore.

(3) Lay clutch retainer (open end up) on a clean, smooth surface. Slide a new bushing on installing head Tool SP-3626, and start them in clutch retainer bore.

(4) Install handle in installing head. Drive bushing into clutch retainer until tool bottoms.

(5) Thoroughly clean clutch retainer before assembly and installation.

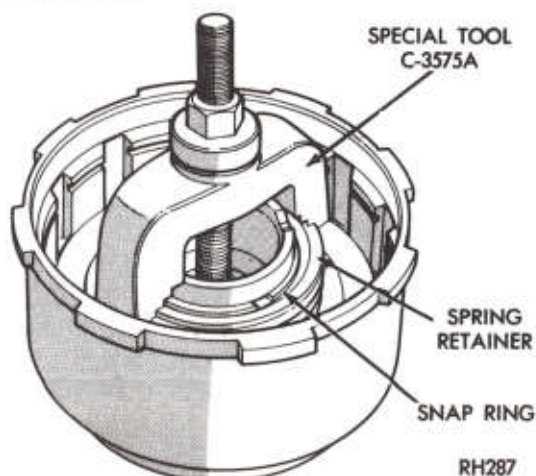


Fig. 19—Front Clutch Spring Retaining Snap Ring (A-904T and A-999)

Assembly

(1) Lubricate and install inner seal on hub of clutch retainer. Make sure lip of seal faces down and seal is properly seated in the groove (Fig. 18).

(2) Install outer seal on the clutch piston, with lip of seal toward bottom of clutch retainer. Apply a coating of wax type lubricant or Door Ease to outer edge of seals and press seal to bottom of its groove around piston diameter for easier installation of piston assembly. Place piston assembly in retainer and carefully seat piston in bottom of retainer.

(3) Place spring on piston hub and position spring retainer and snap ring on the spring. Compress spring with Tool C-3575A (Fig. 19), and seat snap ring in hub groove. Remove compressor tool.

(4) Lubricate all clutch plates, install one steel plate followed by a lined plate (disc) until the number given in specifications is installed. Install pressure plate and snap ring. Make sure snap ring is properly seated.

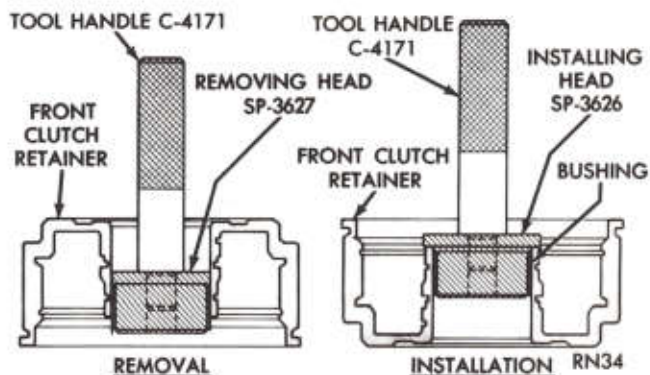


Fig. 20—Replace Front Clutch Retainer Bushing (A-904T and A-999)

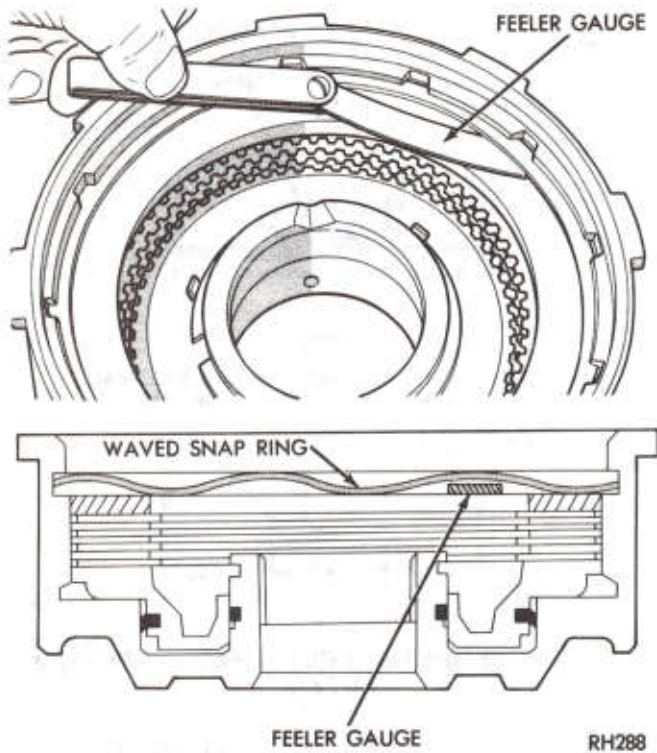


Fig. 21—Measure Front Clutch Plate Clearance

(5) Insert a feeler gauge between pressure plate and waved snap ring to measure maximum clearance where snap ring is waved away from pressure plate (Fig. 21). See "Specifications" for allowed clearance.

FRONT CLUTCH—A-727

Disassembly

Figure 22 shows a disassembled view of the front

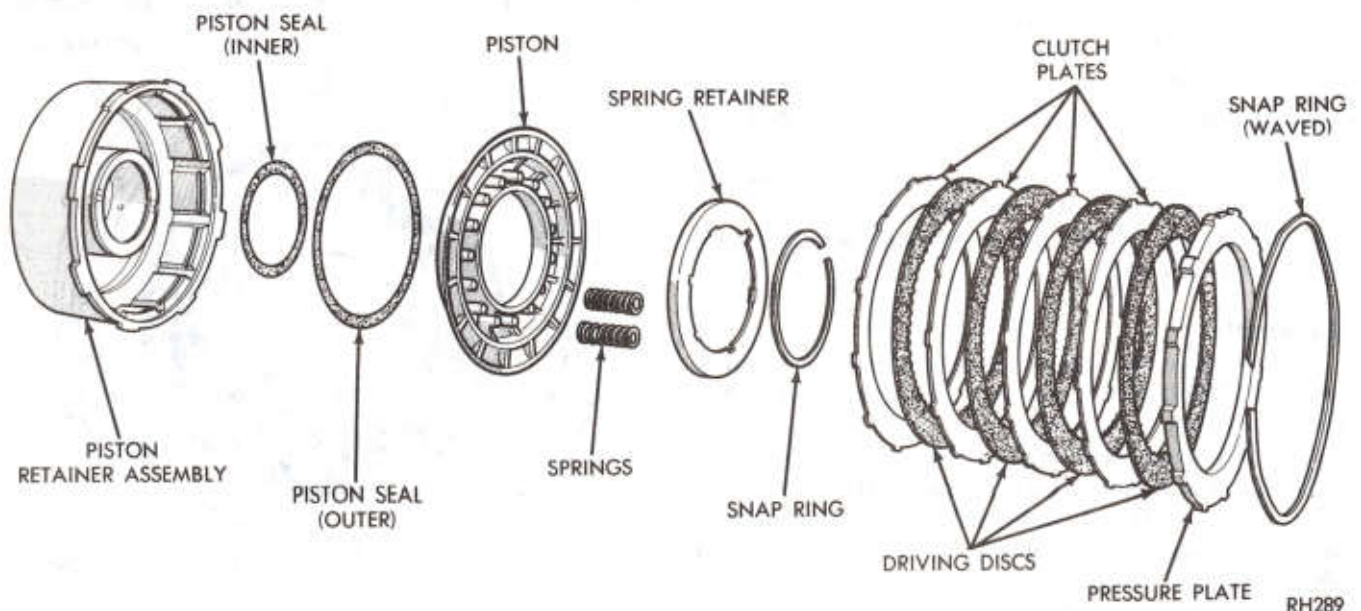


Fig. 22—Front Clutch (A-727)

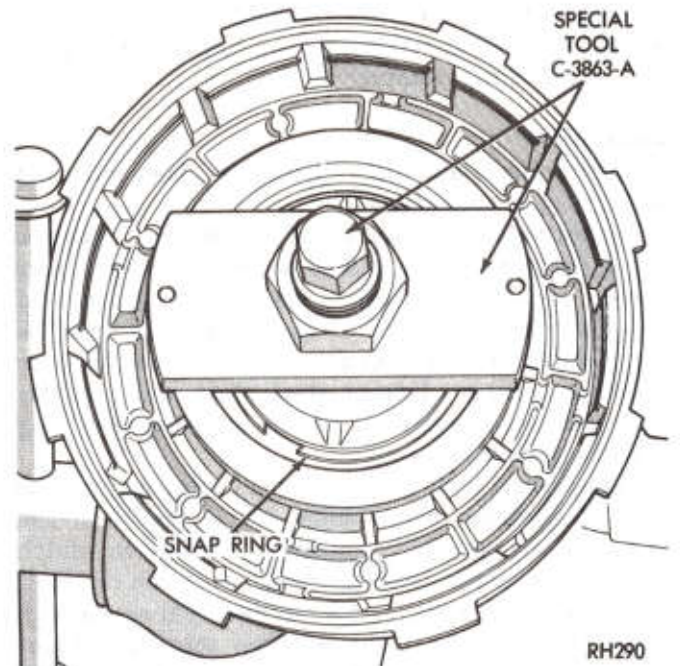


Fig. 23—Front Clutch Spring Retainer Snap Ring (A-727)

clutch assembly.

(1) Remove large waved snap ring that secures pressure plate in clutch piston retainer. Lift pressure plate and clutch plates out of the retainer. (Snap ring in 5 disc clutch is not waved.)

(2) Install compressor Tool C-3863A, over piston spring retainer (Fig. 23). Compress springs and remove snap ring, then slowly release tool until spring retainer is free of hub. Remove tool, retainer, and springs.

(3) Invert clutch retainer assembly and bump it on a wooden block to remove piston. Remove seals from piston and clutch retainer hub.

Inspection

Inspect plates and discs for flatness. They must not be warped or cone shaped.

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces; plates must travel freely in the grooves. Inspect band contacting surface on clutch retainer for scores. Note ball check in clutch retainer, make sure ball moves freely. Inspect seal surfaces in clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing of seals. Inspect clutch retainer bushing for wear or scores.

Inspect inside bore of piston for score marks, if light, remove with crocus cloth. Inspect seal grooves for nicks and burrs. Inspect rubber seals for deterioration, wear, and hardness. Inspect all piston springs, retainer, and snap ring for distortion.

Front Clutch Retainer Bushing Replacement—A-727

(1) Lay clutch retainer (open end down) on a clean, smooth surface and place removing head Tool SP-3629 in the bushing. Install handle Tool C-4171 in removing head (Fig. 24).

(2) Drive bushing straight down and out of clutch retainer bore. Be careful not to cock tool in the bore.

(3) Lay clutch retainer (open end up) on a clean, smooth surface. Slide a new bushing on installing head Tool SP-5511, and start them in clutch retainer bore.

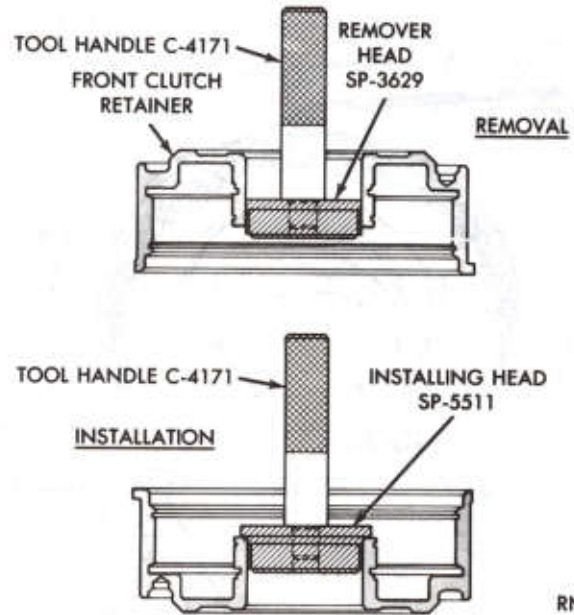
(4) Install handle in the installer. Drive bushing into clutch retainer until tool bottoms.

(5) Thoroughly clean clutch retainer before assembly and installation.

Assembly

(1) Lubricate and install inner seal on hub of clutch retainer. Make sure lip of seal faces down and seal is properly seated in the groove.

(2) Install outer seal on the clutch piston, with lip of seal toward bottom of clutch retainer. Apply a coating of wax type lubricant or Door Ease to outer edge of seals and press seal to bottom of its groove around piston diameter for easier installation of piston assembly. Place piston assembly in retainer and carefully seat piston in bottom of retainer.



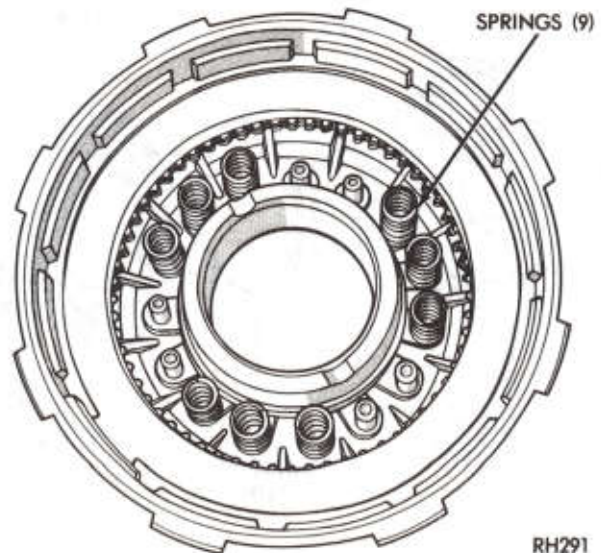
RN36

Fig. 24—Replace Front Clutch Retainer Bushing (A-727)

(3) Refer to "Specifications" and install proper number of springs on piston exactly as shown in Figure 25 or 26. Position spring retainer and snap ring over the springs. Compress springs with Tool C-3863-A (Fig. 23), and seat snap ring in hub groove. Remove compressor tool.

(4) Lubricate all clutch plates, install one steel plate followed by a lined plate (disc) until the number given in specifications is installed. Install pressure plate and snap ring. Make sure snap ring is properly seated.

(5) Insert a feeler gauge between pressure plate and waved snap ring to measure maximum clearance



RH291

Fig. 25—Front Clutch Spring Location (9 Springs)

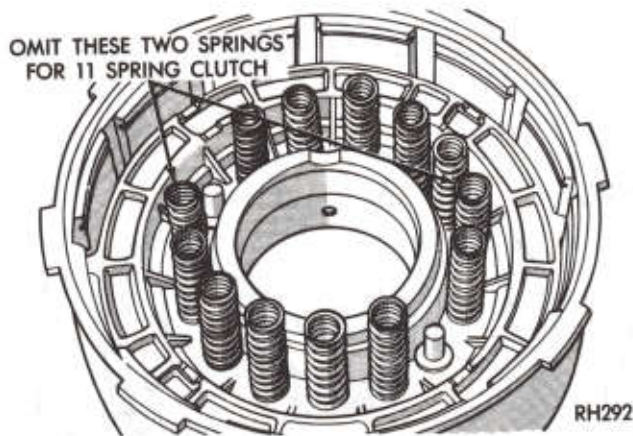


Fig. 26—Front Clutch Spring Location (11 and 13 Springs)

where snap ring is waved away from pressure plate (Fig. 21). See "Specifications" for allowed clearance.

REAR CLUTCH—A-904T and A-999

Disassembly

Figure 27 shows a disassembled view of the rear clutch assembly.

(1) Remove large selective snap ring that secures pressure plate in clutch piston retainer. Lift pressure plate, clutch plates, and inner pressure plate out of the retainer.

(2) Carefully pry one end of wave spring out of its groove in clutch retainer, then remove wave spring, and clutch piston spring.

(3) Invert clutch piston retainer assembly and bump it on a wooden block to remove piston. Remove seals from piston.

(4) If necessary, remove snap ring and press input shaft from piston retainer.

Inspection

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary. Inspect plates and discs for flatness, they must not be warped or cone-shaped.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces; plates must travel freely in the grooves. Note ball check in clutch retainer, make sure ball moves freely. Inspect seal rings surfaces in clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing of the seals. Inspect neoprene seal rings for deterioration, wear and hardness. Inspect piston spring and wave spring for distortion or breakage.

Inspect teflon and/or cast iron seal rings on input shaft for wear (Fig. 27). If required, replacement rings will be cast iron hooked-joint type. Do not remove rings unless conditions warrant. Inspect rear clutch to front clutch #2 thrust washer for wear. Washer thickness should be .061 to .063 inch, replace if necessary.

Assembly

(1) If removed, press input shaft into piston retainer and install snap ring.

(2) Lubricate and install inner and outer seals on clutch piston. Make sure seal lips face toward input shaft, and seals are properly seated in piston grooves (Fig. 27).

(3) Place piston assembly in retainer and, with a twisting motion, seat piston in bottom of retainer.

(4) Place clutch piston spring on top of piston in

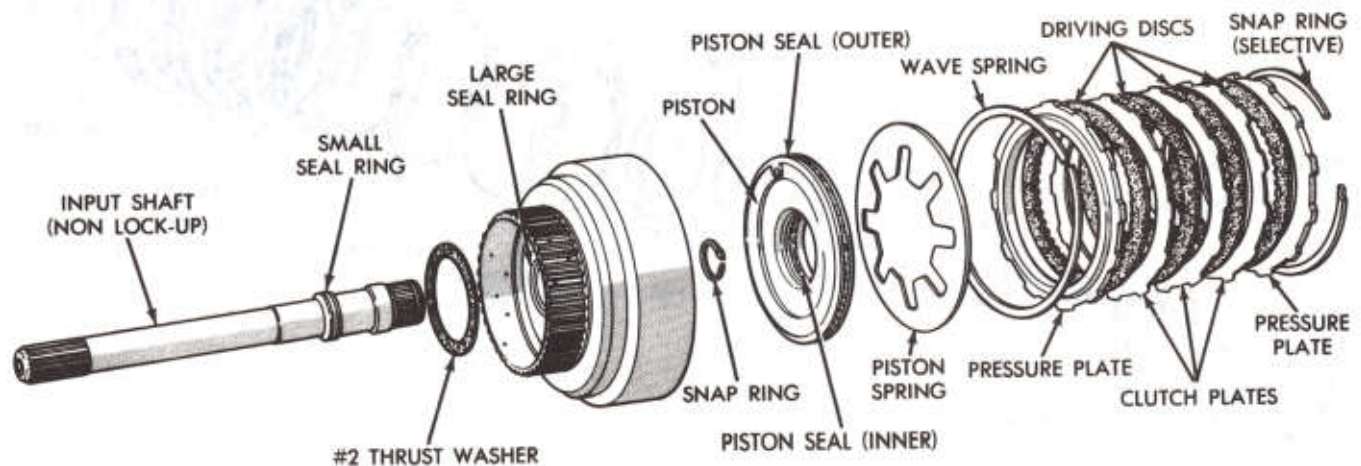


Fig. 27—Rear Clutch (A-904T and A-999 Nonlockup)

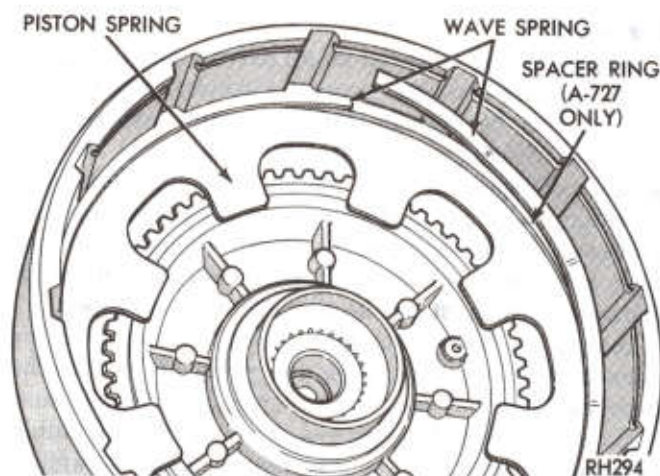


Fig. 28—Install Rear Clutch Spring

clutch retainer. Start one end of wave spring in retainer groove (Fig. 28), then progressively push or tap spring into place making sure it is fully seated in the groove.

(5) Install inner pressure plate in clutch retainer with raised portion of plate resting on the spring.

(6) Lubricate all clutch plates, install one lined disc followed by a steel plate until all plates are installed. Install outer pressure plate and selective snap ring.

(7) Measure rear clutch plate clearance by having an assistant press down firmly on outer pressure plate, then insert a feeler gauge between the plate and snap ring (Fig. 29).

See "Specifications" for allowed clearance. If necessary, install a new snap ring of proper thickness to

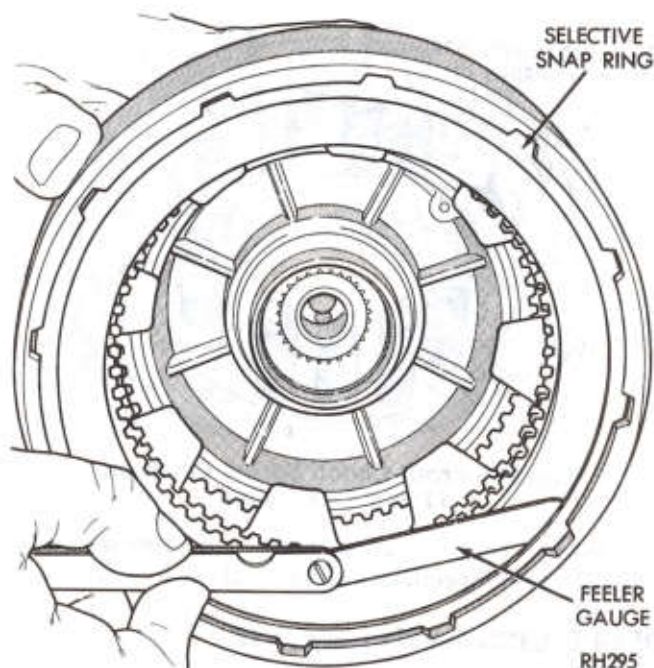


Fig. 29—Measure Rear Clutch Plate Clearance

obtain specified clearance. Low limit clearance is desirable. **Rear clutch plate clearance is very important in obtaining proper clutch operation. Clearance can be adjusted by the use of various thickness outer snap rings. Snap rings are available in .060, .076, and .098 inch thickness.**

(8) Grease cupped side of #3 thrust plate and install cupped side over input shaft.

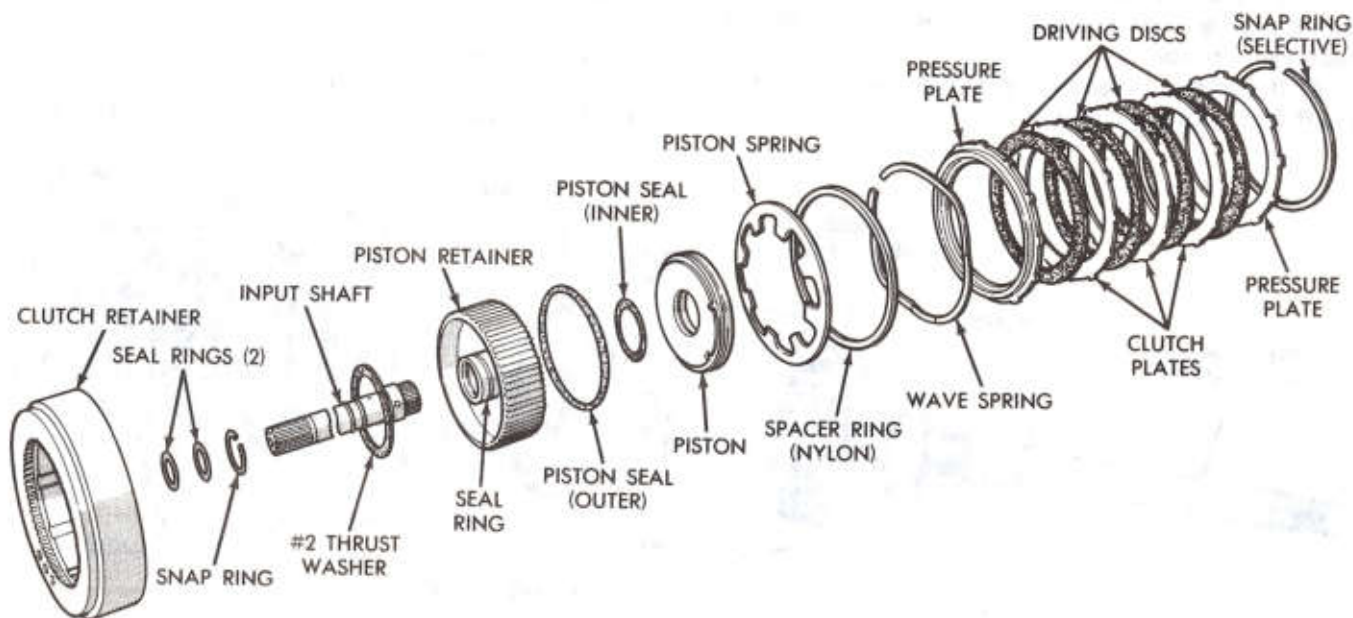


Fig. 30—Rear Clutch (A-727)

RH296

REAR CLUTCH—A-727

Disassembly

Figure 30 shows a disassembled view of the rear clutch assembly.

(1) Remove large selective snap ring that secures pressure plate in clutch retainer. Lift pressure plate, clutch plates, and inner pressure plate out of the retainer.

(2) Carefully pry one end of wave spring out of its groove in clutch retainer, then remove wave spring, spacer ring, and clutch piston spring.

(3) Invert clutch piston retainer assembly and bump it on a wooden block to remove piston. Remove seals from the piston.

(4) If necessary, remove snap ring and press input shaft from clutch piston retainer.

Inspection

Inspect plates and discs for flatness. They must not be warped or cone shaped.

Inspect facing material on all driving discs. Replace discs that are charred, glazed or heavily pitted. Discs should also be replaced if they show evidence of material flaking off or if facing material can be scraped off easily. Inspect driving disc splines for wear or other damage. Inspect steel plate and pressure plate surfaces for burning, scoring or damaged driving lugs. Replace if necessary.

Inspect steel plate lug grooves in clutch retainer for smooth surfaces; plates must travel freely in the grooves. Note ball check in the piston, make sure ball moves freely. Inspect seal surfaces in clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing of seals. Inspect seals for deterioration, wear, and hardness. Inspect piston spring, wave spring, and spacer for distortion or breakage.

Inspect seal rings (Fig. 30) on input shaft for wear or broken locks, make sure they turn freely in the grooves. Do not remove rings unless conditions warrant. Inspect bushing in input shaft for wear or scores. Inspect rear clutch to front clutch #2 thrust washer for wear. Washer thickness should be .061 to .063 inch, replace if necessary.

Input Shaft Bushing Replacement (A-727 only)

(1) Clamp input shaft in a vise with soft jaws, being careful not to clamp on seal ring lands or bearing journals.

(2) Assemble the remover Tool SP-3630, cup Tool SP-3633, and hex-nut Tool SP-1191 (Fig. 31).

(3) With cup held firmly against clutch piston retainer, thread remover into bushing as far as possible by hand.

(4) Using a wrench, screw remover into bushing 3

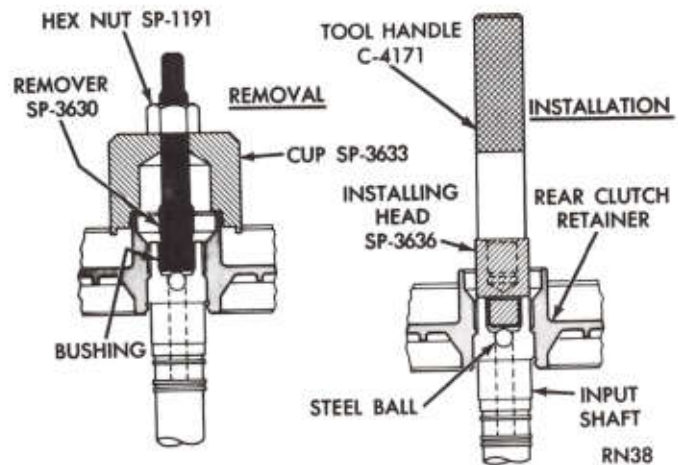


Fig. 31—Replacing Input Shaft Bushing (A-727)

to 4 additional turns to firmly engage threads in the bushing.

(5) Turn hex nut down against cup to pull bushing from input shaft.

(6) Thoroughly clean input shaft to remove chips made by remover threads. Make certain small lubrication hole next to ball in end of shaft is not plugged with chips. Be sure no chips are lodged next to the steel ball.

(7) Slide a new bushing on installing head Tool SP-3636 and start them in the bore of input shaft.

(8) Stand input shaft upright on a clean, smooth surface and install handle Tool C-4171 in the installing head (Fig. 31). Drive bushing into shaft until tool bottoms.

(9) Thoroughly clean input shaft and clutch piston retainer before assembly and installation.

Assembly

(1) If removed, press input shaft into clutch piston retainer and install snap ring.

(2) Lubricate and install inner and outer seals on clutch piston. Make sure seal lips face toward input shaft, and seals are properly seated in piston grooves (Fig. 30).

(3) Place piston assembly in retainer and, with a twisting motion, seat piston in bottom of the retainer.

(4) Position clutch retainer over piston retainer splines and support the assembly so clutch retainer remains in place.

(5) Place clutch piston spring and spacer ring on top of piston in clutch retainer, make sure spring and spacer ring are positioned in the retainer recess. Start one end of wave spring in retainer groove (Fig. 28), then progressively push or tap spring into place making sure it is fully seated in the groove.

(6) Install inner pressure plate in clutch retainer with raised portion of plate resting on the spring.

(7) Lubricate all clutch plates, install one lined disc

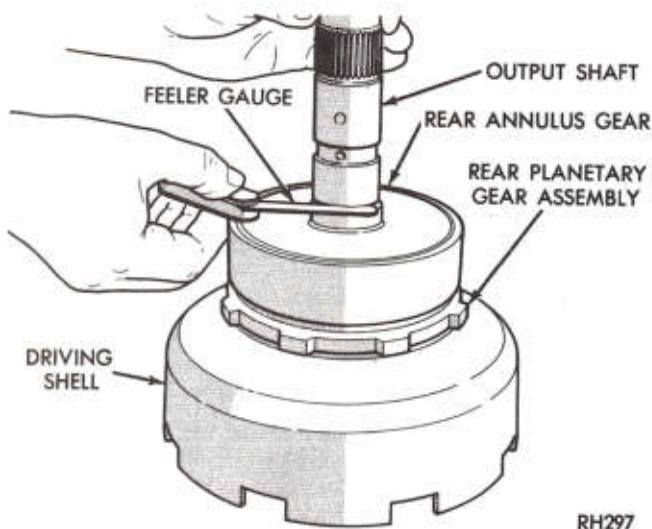


Fig. 32—Measure End Play of Planetary Gear Train

followed by a steel plate until all plates are installed. Install outer pressure plate and selective snap ring.

(8) Measure rear clutch plate clearance by having an assistant press downward firmly on outer pressure plate, then insert a feeler gauge between the plate and snap ring (Fig. 29). See "Specifications" for allowed clearance. If necessary, install a new snap ring of proper thickness to obtain specified clearance. Low limit clearance is desirable. **Rear clutch plate clearance is very important in obtaining proper clutch operation. The clearance can be adjusted by the use of various thickness outer snap rings. Snap rings are available in .060, .074, .088, and .106 inch thickness.**

(9) Install #3 thrust washer on rear end of input shaft, using grease to hold in place.

PLANETARY GEAR TRAIN—A-904T and A-999

End Play

Measure end play of planetary gear assemblies, sun gear and driving shell before removing these parts from output shaft. Stand assembly upright with forward end of output shaft on a wooden block so that all parts will move forward against selective snap ring at front of shaft. Insert a feeler gauge between rear annulus gear support hub and shoulder on output shaft. (Fig. 32). The clearance should be .005 to .048 inch. If clearance exceeds specifications, replace thrust washers and/or necessary parts.

Disassembly (Fig. 33)

(1) Remove selective #3 thrust washer from forward end of output shaft.

(2) Remove selective snap ring from forward end of output shaft, then slide front planetary assembly off the shaft.

(3) Remove snap ring and #4 thrust washer from forward hub of front planetary gear assembly, slide front annulus gear and support off planetary gear assembly. Remove #5 thrust washer from front side of planetary gear assembly. Remove #6 thrust washer from rear side of planetary gear assembly. If necessary, remove snap ring from front of annulus gear to separate support from annulus gear.

(4) Slide sun gear, driving shell, and rear planetary assembly off the output shaft.

(5) Lift sun gear and driving shell off rear planetary

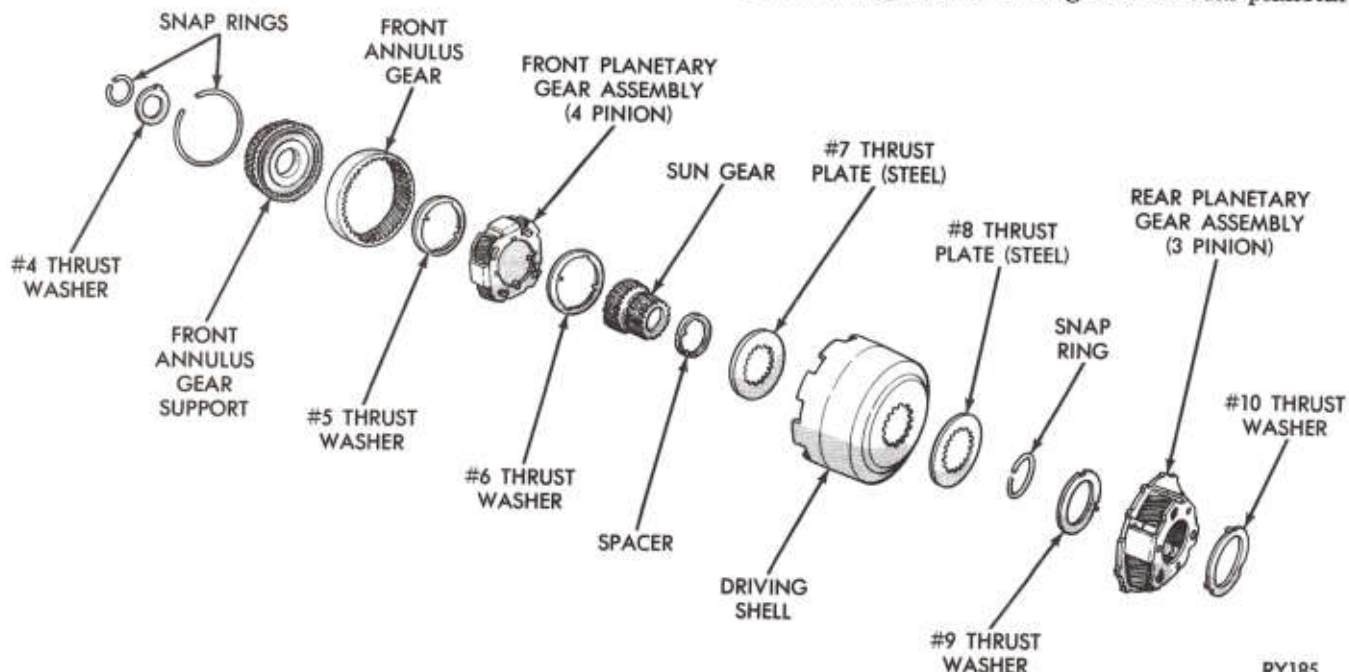


Fig. 33—Wide-Ratio Planetary Gear Train

assembly. Remove snap ring and #8 thrust plate from sun gear (rear side of driving shell). Slide sun gear out of driving shell, and remove spacer (Fig. 33), and #7 thrust plate from opposite end of sun gear, if necessary.

(6) Remove #9 thrust washer from forward side of rear planetary assembly and remove planetary gear assembly from rear annulus gear. Remove #10 thrust washer from rear side of planetary assembly. If necessary, remove snap ring from rear of annulus gear to separate support from annulus gear.

Inspection

Inspect bearing surfaces on output shaft for nicks, burrs, scores or other damage. Light scratches, small nicks or burrs can be removed with crocus cloth or a fine stone. Inspect speedometer drive gear for any nicks or burrs, and remove with a sharp-edged stone. Make sure all oil passages in shaft are open and clean.

Inspect bushings in sun gear for wear or scores, replace sun gear assembly if bushings are damaged. Inspect all thrust washers for wear and scores, replace if damaged or worn below specifications. Inspect thrust faces of planetary gear carriers for wear, scores or other damage, replace as required. Inspect planetary gear carrier for cracks and pinions for broken or worn gear teeth, and for broken pinion shaft welds. Inspect annulus gear and driving gear teeth for damage. Replace distorted lock rings.

Assembly

Refer to Figure 33 for parts reference.

(1) Place rear annulus gear support in annulus gear and install snap ring.

(2) Position #10 thrust washer on rear side of rear planetary gear assembly and install in rear annulus gear. Install #9 thrust washer on front side of rear

planetary gear assembly.

(3) Insert output shaft in rear opening of rear annulus gear. Carefully work shaft through annulus gear support and planetary gear assembly. Make sure shaft splines are fully engaged in splines of annulus gear support.

(4) Install #7 thrust plate and spacer on wide-ratio transmissions (Fig. 33) on one end of sun gear. Insert sun gear through front side of driving shell, install #8 thrust plate and snap ring.

(5) Carefully slide driving shell and sun gear assembly on the output shaft, engaging sun gear teeth with rear planetary pinion teeth.

(6) Place front annulus gear support in the annulus gear and install snap ring.

(7) Position #5 thrust washer on front side of front planetary gear assembly. Position front planetary gear assembly in front annulus gear, place #4 thrust washer over planetary gear assembly hub and install snap ring. Position #6 thrust washer on rear side of planetary gear assembly.

(8) Carefully work front planetary and annulus gear assembly on output shaft, meshing planetary pinions with sun gear teeth.

(9) With all components properly positioned, install selective snap ring on front end of output shaft. Remeasure end play of the assembly. **The clearance can be adjusted by the use of various thickness snap rings. Snap rings are available in .042, .064, and .084 inch thickness.**

PLANETARY GEAR TRAIN—A-727 (Fig. 34)

End Play

Measure end play of planetary gear assemblies, sun gear and driving shell before removing these parts from output shaft. Stand assembly upright with for-

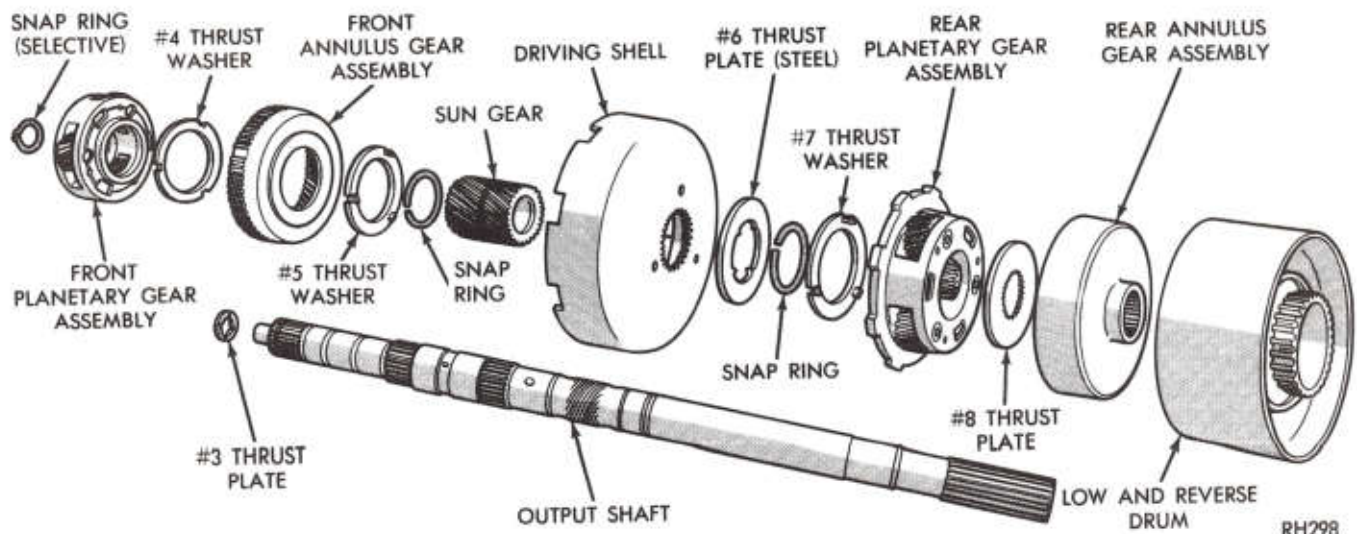


Fig. 34—Planetary Gear Train and Output Shaft (A-727)

ward end of output shaft on a wooden block so that all parts will move forward against selective snap ring at front of shaft. Insert a feeler gauge between rear annulus gear support hub and shoulder on output shaft (Fig. 32). **The clearance should be .006 to .048 inch.** If clearance exceeds specifications replace thrust washers and/or necessary parts.

Disassembly

(1) Remove #3 thrust plate from forward end of output shaft (Fig. 34).

(2) Remove selective snap ring from forward end of output shaft, then slide front planetary assembly off the shaft.

(3) Slide front annulus gear off planetary gear assembly. Remove #4 thrust washer from rear side of planetary gear assembly.

(4) Slide sun gear, driving shell, and rear planetary assembly off output shaft.

(5) Lift sun gear and driving shell off rear planetary gear assembly. Remove #5 thrust washer from inside the driving shell. Remove snap ring and #6 thrust plate from sun gear (rear side of driving shell) and slide sun gear out of the shell. Remove front snap ring from sun gear if necessary. Note that front end of sun gear is longer than rear.

(6) Remove #7 thrust washer from forward side of rear planetary gear assembly, remove planetary gear set and #8 thrust plate from rear annulus gear.

Inspection

Inspect bearing surfaces on output shaft for nicks, burrs, scores or other damage. Light scratches, small nicks or burrs can be removed with crocus cloth or a fine stone. Inspect speedometer drive gear for any nicks or burrs, and remove with a sharp-edged stone. Make sure all oil passages in shaft are open and clean.

Inspect bushings in sun gear for wear or scores, replace sun gear assembly if bushings are damaged. Inspect all thrust washers for wear and scores, replace if damaged or worn below specifications. Inspect thrust faces of planetary gear carriers for wear, scores or other damage, replace as required. Inspect planetary gear carrier for cracks and pinions for broken or worn gear teeth and for broken pinion shaft lock pins. Inspect annulus gear and driving gear teeth for damage. Replace distorted lock rings.

Assembly

Refer to Figure 34 for parts identification.

(1) Install rear annulus gear on the output shaft. Apply a thin coat of grease on #8 thrust plate, place it on the shaft and in the annulus gear making sure teeth are over the shaft splines.

(2) Position rear planetary gear assembly in the rear annulus gear. Place #7 thrust washer on front

side of planetary gear assembly.

(3) Install snap ring in front groove of sun gear (long end of gear). Insert sun gear through front side of driving shell, install rear #6 thrust plate and snap ring.

(4) Carefully slide driving shell and sun gear assembly on output shaft, engaging sun gear teeth with rear planetary pinion teeth. Place #5 thrust washer inside the front driving shell.

(5) Place #4 thrust washer on rear hub of front planetary gear assembly, then slide assembly into front annulus gear.

(6) Carefully work front planetary and annulus gear assembly on output shaft, meshing planetary pinions with the sun gear teeth.

(7) With all components properly positioned, install selective snap ring on front end of output shaft. Remeasure end play of the assembly. **The clearance can be adjusted by the use of various thickness snap rings. Snap rings are available in .048, .055, and .062 inch thickness.**

OVERRUNNING CLUTCH

Inspection

Inspect clutch rollers for smooth, round surfaces, they must be free of flat spots and chipped edges. Inspect roller contacting surfaces in the cam and race for brinelling. Inspect roller springs for distortion, wear or other damage.

A-727: Inspect cam set screw for tightness. If loose, tighten and restake the case around screw.

Overrunning Clutch Cam Replacement— A-904T and A-999

If overrunning clutch cam or spring retainer are found damaged, they can be replaced with a service replacement cam, spring retainer, and retaining bolts (Fig. 35).

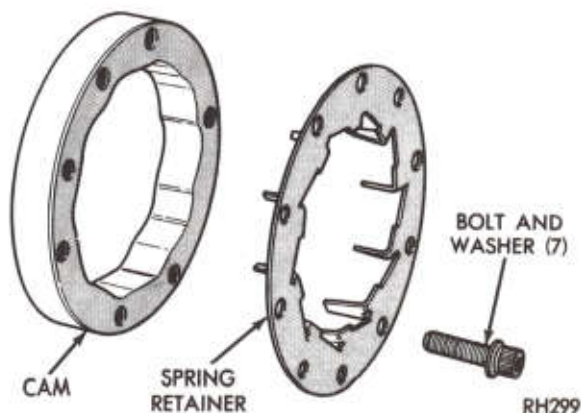


Fig. 35—Overrunning Clutch Service Replacement Cam (A-904T and A-999)

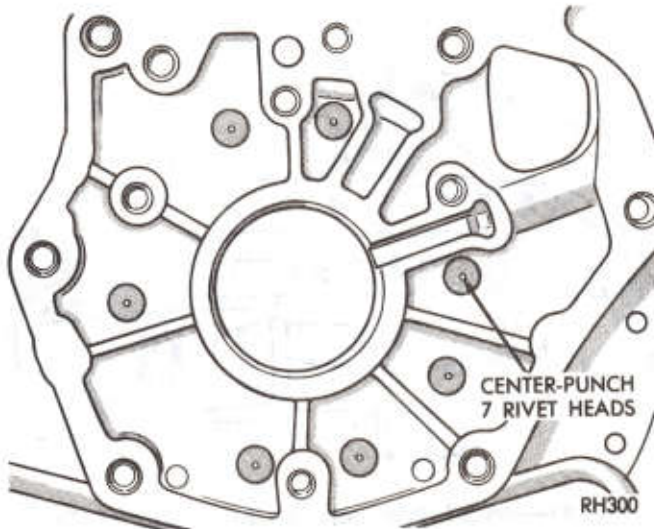


Fig. 36—Center Punch Rivet Heads (A-904T and A-999)

The service parts are retained in the case with bolts instead of rivets. To install, proceed as follows:

(1) Remove four bolts securing output shaft support to rear of the transmission case. Tap support rearward out of the case with a soft-faced hammer.

(2) Center punch the rivets exactly in center of each rivet head (Fig. 36).

(3) Drill through each rivet head with a 3/8 inch drill. Be careful not to drill into the transmission case. Chip off rivet heads with a small chisel, then drive rivets and cam from the case with a blunt punch of proper size.

(4) Carefully enlarge rivet holes in the case with a 17/64 inch drill. Remove all chips and foreign matter from the case, make sure cam area is free of chips and burrs.

(5) To install, position cam and roller spring retainer in the case. Align cam bolt holes with holes in

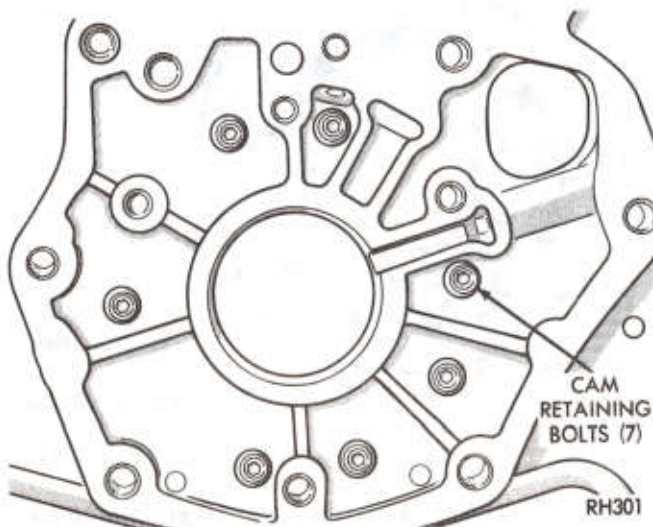


Fig. 37—Cam Retaining Bolts (A-904T and A-999)

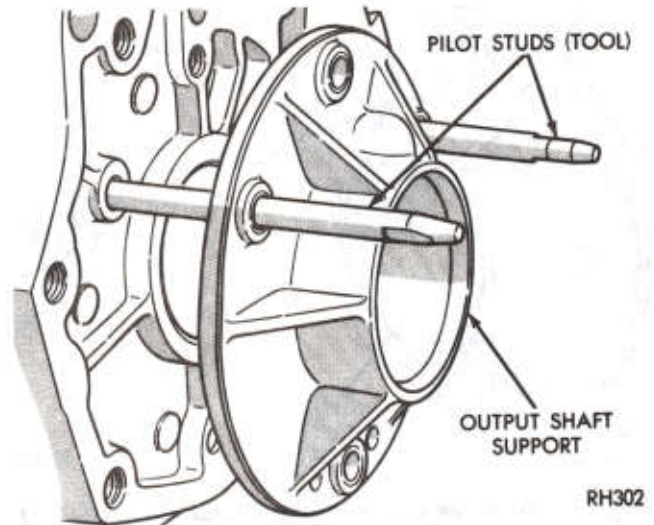


Fig. 38—Install Output Shaft Support (A-904T and A-999)

the case, then thread all seven retaining bolt and washer assemblies into cam a few turns. The cone washers must be installed so inner diameter is coned toward the bolt head (Fig. 37).

(6) Tap cam firmly into the case if necessary. Draw retaining bolts down evenly, then tighten to 100 in. lbs. (11 N·m).

(7) Screw two pilot studs Tool C-3288-B into the case (Fig. 38). Position support over the pilot studs, and tap it firmly into the case with a soft-faced hammer.

(8) Remove pilot studs, install bolts and tighten to 150 in. lbs. (17 N·m).

Overrunning Clutch Cam Replacement—A-727

If overrunning clutch cam and/or roller spring retainer are found damaged, replace cam and spring retainer in the following manner:

(1) Remove set screw from the case below clutch cam.

(2) Remove bolts securing output shaft support to rear of transmission case. Insert a punch through bolt holes and drive cam from the case (Fig. 39). Alternate punch from one bolt hole to another so cam will be driven evenly from the case.

The output shaft support must be in the case to install the overrunning clutch cam.

If the support requires replacement, tap support rearward with a soft-faced hammer. To install, screw two C-3288B pilot studs into the case (Fig. 40). Position support over the pilot studs, and tap it firmly into the case with a soft-faced hammer.

(3) Clean all burrs and chips from cam area in the case.

(4) Place spring retainer on the cam, making sure retainer lugs snap firmly into notches on the cam.

(5) Position cam in the case with cam serrations

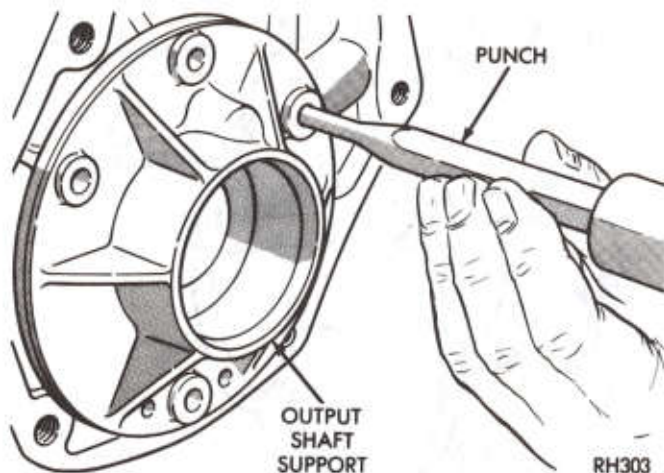


Fig. 39—Remove Overrunning Clutch Cam (A-727)

aligned with those in the case. Tap cam evenly into the case as far as possible with a soft-faced hammer.

(6) Install Tool C-3863A and Adapter SP-5124 as shown in Figure 41, tighten nut on tool to seat cam into the case. Make sure cam is firmly bottomed, then install cam retaining set screw. Stake the case around set screw to prevent it coming loose.

(7) Remove cam installing tool. Remove pilot studs, install bolts and tighten to 150 in. lbs. (17 N·m). Stake the case around cam in 12 places with a blunt chisel (Fig. 42).

KICKDOWN SERVO AND BAND

Disassembly

Disassemble controlled load servo piston by removing small snap ring from servo piston. Then remove washer, spring and piston rod assembly from servo piston.

Inspection

Inspect piston and guide seal rings for wear, and

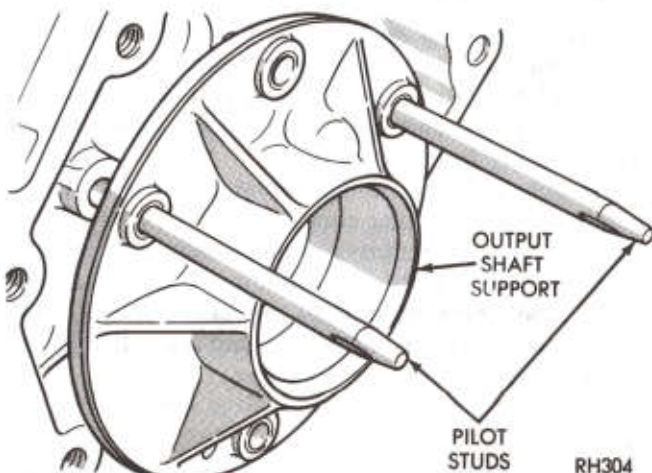


Fig. 40—Install Output Shaft Support (A-727)

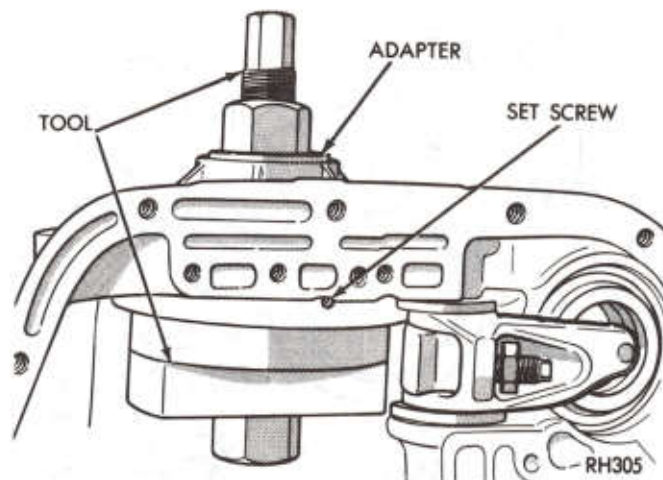


Fig. 41—Install Overrunning Clutch Cam (A-727)

make sure they turn freely in the grooves. It is not necessary to remove seal rings unless conditions warrant. Inspect piston for cracks, burrs, scores and wear. Inspect piston bore in the case for scores or other damage. Inspect fit of guide on piston rod. Inspect piston spring for distortion.

For controlled load servo, inspect bore in piston and O-ring on piston rod.

Inspect band lining for wear and bond of lining to the band. Inspect lining for black burn marks, glazing, nonuniform wear pattern and flaking. If lining is worn so grooves are not visible at ends or any portion of the bands, replace the band. Inspect band for distortion or cracked ends.

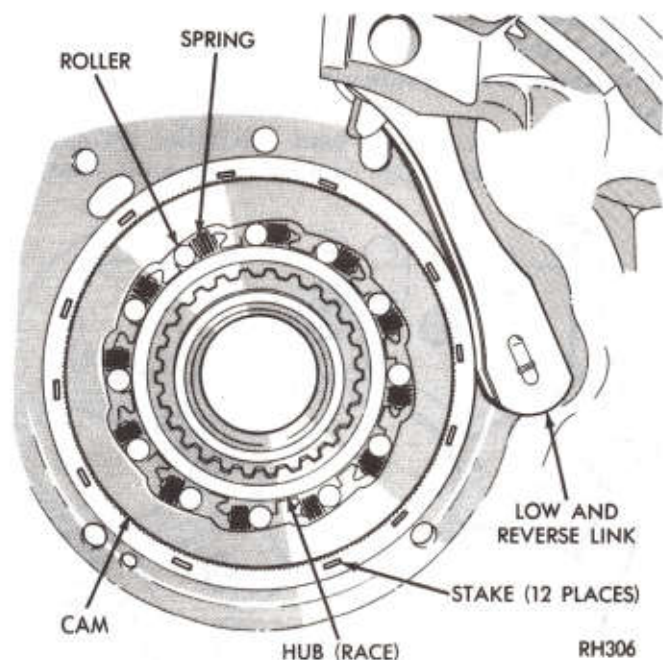


Fig. 42—Overrunning Clutch, Low-Reverse Band Link

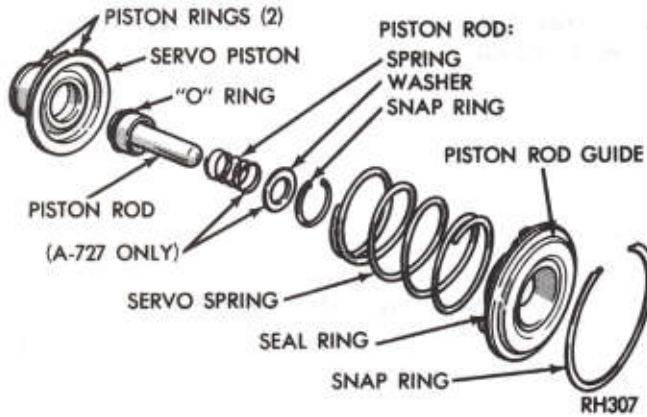


Fig. 43—Kickdown Servo

Assembly

Assemble controlled load servo piston as follows (Fig. 43).

- (1) Grease O-ring and install piston rod.
- (2) Install piston rod into servo piston.
- (3) Install spring, flat washer and snap ring to complete the assembly.

LOW-REVERSE SERVO AND BAND**Disassembly**

- (1) Remove snap ring from piston and remove the piston plug and cushion spring (Fig. 44).

Inspection

Inspect seal for deterioration, wear and hardness. Inspect piston and piston plug for cracks, burrs, scores and wear; piston plug must operate freely in the piston. Inspect piston bore in the case for scores or other damage. Inspect springs for distortion.

Inspect band lining for wear and bond of lining to the band. If lining is worn so grooves are not visible at ends or any portion of the band, replace the band. Inspect band for distortion or cracked ends.

Assembly

- (1) Lubricate and insert piston plug and cushion spring in the piston, and secure with snap ring.

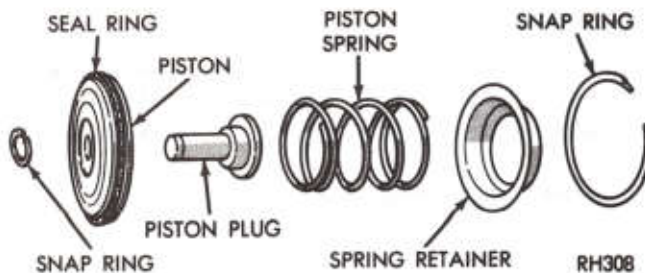


Fig. 44—Low-Reverse Servo

ASSEMBLY—SUBASSEMBLY INSTALLATION

The assembly procedures given here include installation of subassemblies in the transmission case and adjusting input shaft end play. Do not use force to assemble mating parts. If parts do not assemble freely, investigate the cause, and correct the trouble before proceeding with assembly procedures. Always use new gaskets during assembly operations.

Use only automatic transmission fluid to lubricate transmission parts during assembly.

Overrunning Clutch

- (1) With transmission case in an upright position, insert clutch hub inside the cam. Install overrunning clutch rollers and springs as shown in Figure 42.

Low-Reverse Servo, Band, and Linkage—A-727 (Fig. 45)

- (1) Carefully work servo piston assembly into the case with a twisting motion. Place spring retainer, and snap ring over the piston (Fig. 44).
- (2) Compress low-reverse servo piston spring by using engine valve spring compressor Tool C-3422A, then install snap ring.
- (3) Position rear band in the case, install short strut, then connect long link and anchor to the band. Screw in band adjuster just enough to hold strut in place. Install low-reverse drum. Be sure long link and anchor assembly is installed as shown in Figure 42, to provide running clearance for the low-reverse drum.

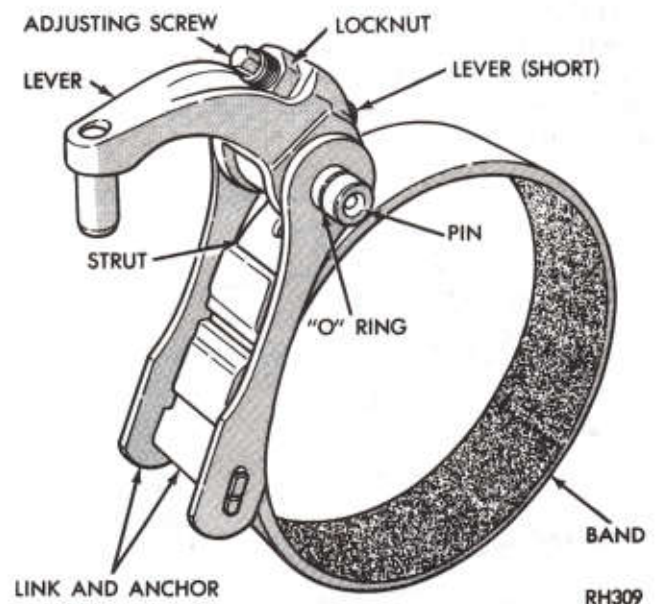


Fig. 45—Low-Reverse Band and Linkage (A-727)

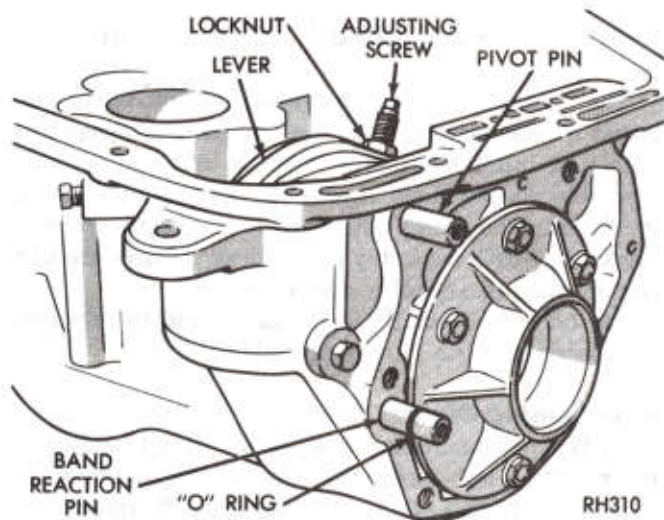


Fig. 46—Double-Wrap Band Linkage (A-904T and A-999)

Double-Wrap Low-Reverse Band (A-904T and A-999) (Figs. 46 and 47)

- (1) Push band reaction pin (with new O-ring) into case flush with gasket surface.
- (2) Place band into case resting two lugs against band reaction pin.
- (3) Install low-reverse drum into overrunning clutch and band.
- (4) Install operating lever with pivot pin flush in case and adjusting screw touching center lug on band.

Kickdown Servo (Fig. 43)

- (1) Carefully push servo piston assembly into the case bore. Install spring, guide, and snap ring.
- (2) Compress kickdown servo springs by using engine valve spring compressor Tool C-3422-A, then install snap ring.

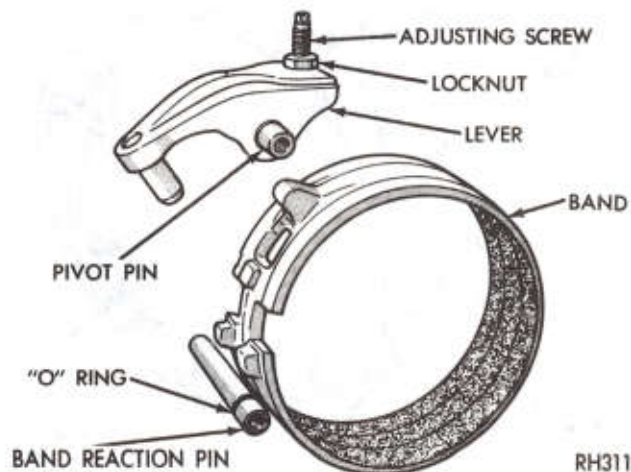


Fig. 47—Double-Wrap Band and Linkage (A-904T and A-999)

Planetary Gear Assemblies, Sun Gear, and Driving Shell

(1) While supporting assembly in the case, insert output shaft through rear support. Carefully work assembly rearward engaging rear planetary carrier lugs into low-reverse drum slots.

Be very careful not to damage ground surfaces on output shaft during installation.

Front and Rear Clutch Assemblies

The front and rear clutches, front band, oil pump and reaction shaft support are more easily installed with transmission in an upright position.

One method to support transmission, is outlined in Steps (1) and (2).

(1) Cut a 3 1/2 inch (89mm) diameter hole in a bench, in the end of a small oil drum, or a large wooden box strong enough to support transmission. Cut or file notches at edge of the 3 1/2 inch (89mm) hole so output shaft support will fit and lay flat in the hole.

(2) Carefully insert output shaft into hole to support the transmission upright, with its weight resting on flange of the output shaft support.

(3) **A-904T and A-999:** Apply a light coat of grease to selective thrust washer and install washer on front end of the output shaft. Apply a light coat of grease to input shaft thrust plate and install over input shaft. If input shaft end play was not within specifications (.022 to .091 inch), when tested before disassembly, replace thrust washer with one of proper thickness. Refer to thrust washer number 3 in "Specifications" for sizes available.

A-727: Apply a coat of grease on the input to output shaft thrust plate Number 3 (Fig. 34), and install plate on front end of the output shaft. Apply a light coat of grease to the 3-tab thrust washer and install in rear clutch piston retainer.

(4) Align front clutch plate inner splines, and place assembly in position on the rear clutch. Make sure front clutch plate splines are fully engaged on rear clutch splines.

(5) Align rear clutch plate inner splines, grasp input shaft and lower the two clutch assemblies into the transmission case.

(6) Carefully work clutch assemblies in a circular motion to engage rear clutch splines over splines of front annulus gear. Make sure front clutch drive lugs are fully engaged in slots in the driving shell.

Kickdown Band (Fig. 48)

- (1) Slide band over front clutch assembly.
- (2) Install band strut, screw in adjuster just enough to hold strut and anchor in place.

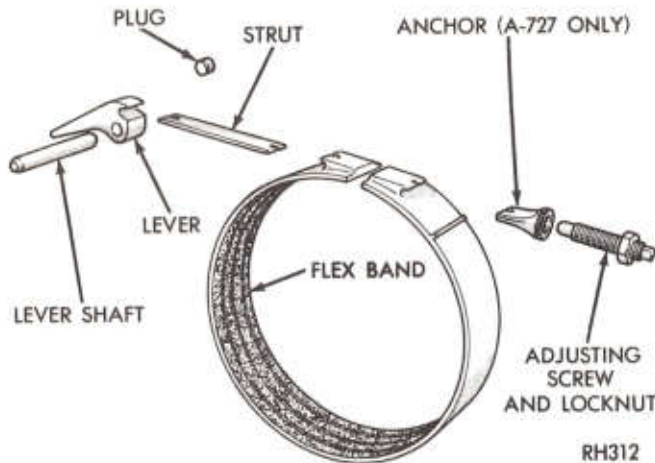


Fig. 48—Kickdown Band and Linkage

Oil Pump and Reaction Shaft Support

If difficulty was encountered in removing pump assembly, due to an exceptionally tight fit in the case, it may be necessary to expand the case with heat during pump installation. Using a suitable heat lamp, heat the case in area of pump for a few minutes prior to installing pump and reaction shaft support assembly.

A-904T and A-999: Install number one thrust washer on reaction shaft support hub (Fig. 9).

A-727: If input shaft end play was not within specifications (.034 to .084 inch) when measured before disassembly, replace thrust washer on reaction shaft support hub with one of proper thickness (Fig. 14). Refer to thrust washer number one in "Specifications" for sizes available.

(1) Screw two pilot studs Tool C-3288-B in pump opening in the case (Fig. 49). Install a new gasket over

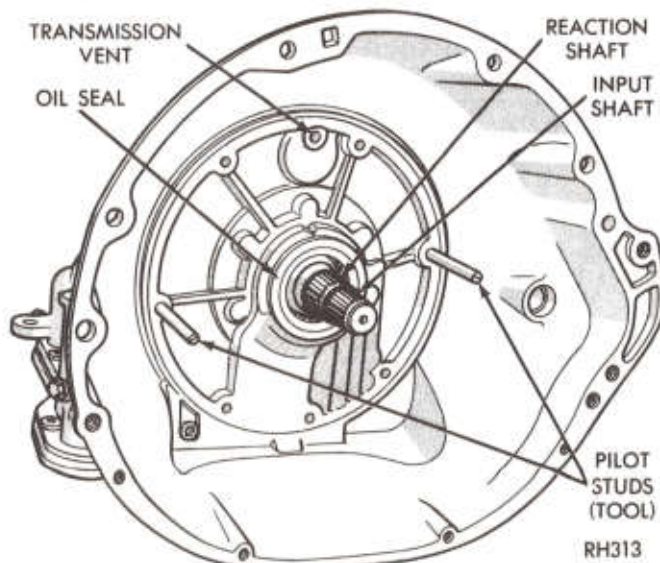


Fig. 49—Installing Oil Pump

the pilot studs.

(2) Place a new rubber seal ring in the groove on outer flange of pump housing. Make sure seal ring is not twisted. Coat seal ring with grease for easy installation.

(3) Install pump assembly in the case; tap it lightly with a soft mallet, if necessary. Remove pilot studs, install bolts and snug down evenly.

Rotate input and output shafts to see if any binding exists, then tighten bolts to 175 in. lbs. (20 N·m). Check shafts again for free rotation.

(4) Adjust both bands as described in "Maintenance and Adjustments" Section.

Governor and Support

(1) Position support and governor body assembly on the output shaft. Align assembly so governor valve shaft hole in governor body aligns with hole in output shaft, then slide assembly into place. Install snap ring behind the governor body. Tighten body to support self-locking bolts to 95 in. lbs. (11 N·m).

(2) Place governor valve on valve shaft, insert assembly into body and through governor weights. Install valve shaft retaining snap ring.

Output Shaft Bearing and Extension Housing (or Adapter on 4WD Vehicles)

(1) Install a snap ring in the front groove (A-727 only) on output shaft. Install bearing on shaft with its outer race ring groove toward front. Press or tap bearing tight against front snap ring (or shoulder on A-904T and A-999) then install rear snap ring.

(2) On 4WD vehicles, use door-ease lubricant on output shaft bearing O-ring. Drive the bearing into adapter using Tool C-4203 inverted with Handle C-4171.

(3) Place a new extension housing gasket on the transmission case. Position output shaft bearing retaining snap ring as far as possible then carefully tap extension housing (or adapter) into place. Make sure snap ring is fully seated in the bearing groove.

(4) Install and tighten extension housing (or adapter) bolts to 32 ft. lbs. (43 N·m).

(5) Install gasket, plate, and screws on bottom of extension housing mounting pad.

Measure input shaft end play as described under "Disassembly—Subassembly Removal." Correct if necessary (Fig. 5).

Valve Body Assembly and Accumulator Piston

(1) Make sure combination back-up lamp/neutral start switch is not installed in transmission case.

(2) Place valve body manual lever in low position to move parking rod to rear position.

(3) Use a screwdriver to push park sprag into engagement with parking gear, turning output shaft to

verify engagement. This will allow "knob" on end of parking rod to move past the sprag as valve body is installed.

(4) Install accumulator piston in the transmission case (Fig. 50).

(5) Place valve body in position, working park rod through opening and past sprag. Install retaining bolts finger tight.

(7) With neutral-starting switch installed, place manual lever in the neutral position. Shift valve body, if necessary, to center neutral finger over the neutral switch plunger. Snug bolts down evenly, then tighten to 105 in. lbs. (12 N·m).

(8) Connect lock-up solenoid wire to wiring connector at rear of transmission case, if so equipped.

(9) Install gearshift lever and tighten clamp bolt. Check lever shaft for binding in the case by moving lever through all detent positions. If binding exists, loosen valve body bolts and realign.

(10) Make sure throttle shaft seal is in place, then install flat washer and throttle lever and tighten the clamp bolt.

(11) Position the round magnet over the bump in the front, right hand corner of the oil pan.

(12) Install oil pan, and a new gasket.

TRANSMISSION, TORQUE CONVERTER, AND DRIVE PLATE INSTALLATION

The transmission and torque converter must be installed as an assembly; otherwise, the torque converter drive plate, pump bushing, and oil seal will be damaged. None of the weight of transmission should be allowed to rest on the plate during installation.

(1) Rotate pump gears with Tool C-3756 (A-904T and A-999) or Tool C-3881 (A-727) until the two small holes in handle are vertical (Fig. 51).

(2) Carefully slide torque converter assembly over input shaft and reaction shaft. Make sure torque converter hub slots are also vertical and fully engage pump inner gear lugs.

Test for full engagement by placing a straightedge on face of the case (Fig. 52). The surface of torque converter front cover lug should be at least 1/2 inch to rear of straightedge when torque converter is pushed

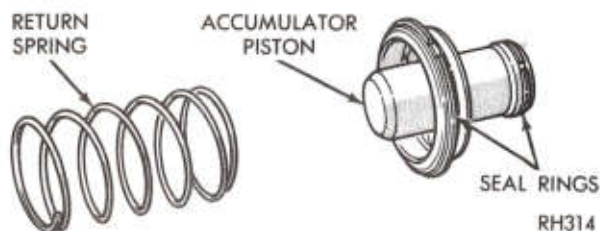


Fig. 50—Accumulator Piston and Spring

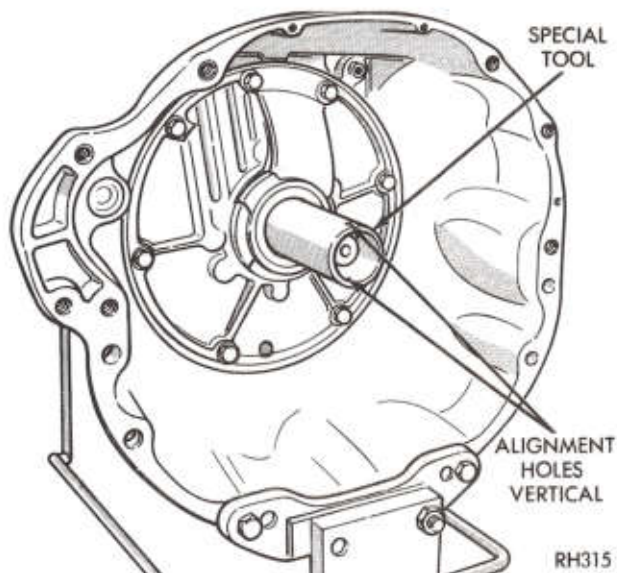


Fig. 51—Align Pump Inner Gear Lugs

all the way into transmission.

(3) Attach a small C-clamp to edge of torque converter housing to hold torque converter in place during transmission installation.

(4) Inspect torque converter drive plate for distortion or cracks and replace if necessary. Torque the drive plate to crankshaft bolts to 55 ft. lbs. (75 N·m). **When drive plate replacement has been necessary, make sure both transmission dowel pins are in engine block and they are protruding far enough to hold transmission in alignment.**

(5) Coat torque converter hub hole in crankshaft with Multipurpose grease. Place transmission and torque converter assembly on a service jack and

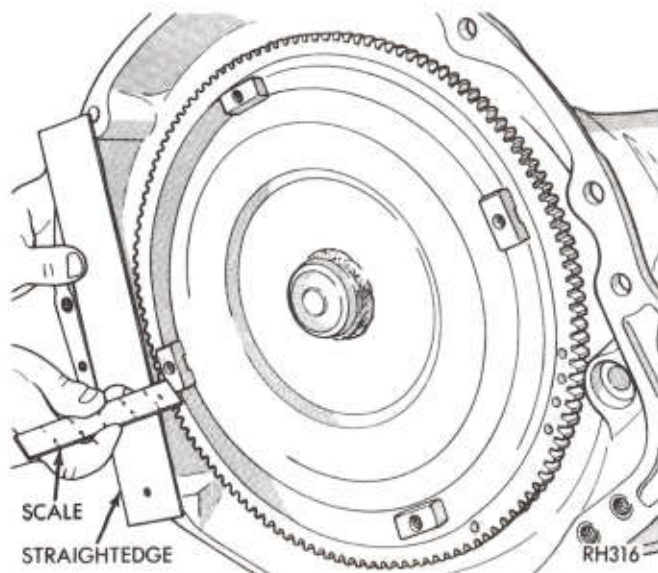


Fig. 52—Measure Torque Converter for Full Engagement into Transmission

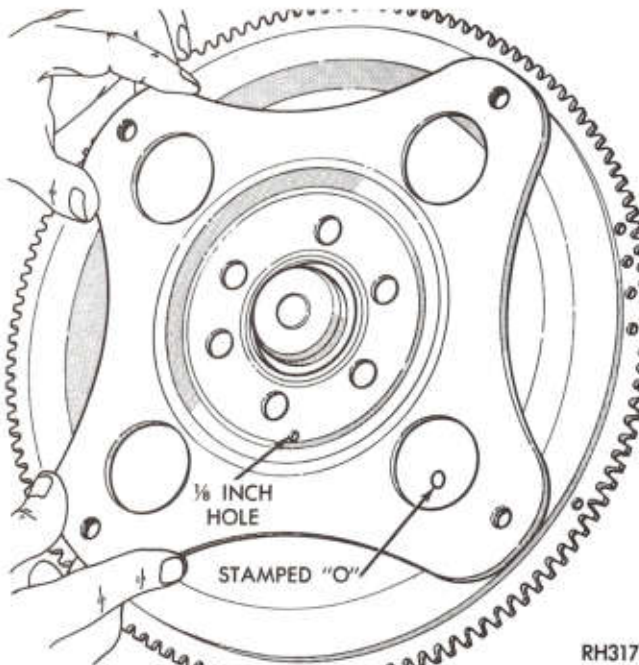


Fig. 53—Torque Converter and Drive Plate Markings

position assembly under vehicle for installation. Raise or tilt as necessary until transmission is aligned with engine.

(6) Rotate torque converter so mark on torque converter (made during removal) will align with mark on drive plate. The offset holes in plate are located next to 1/8 inch hole in the inner circle of plate. Carefully work transmission assembly forward over engine block dowels with torque converter hub entering the crankshaft opening.

(7) After transmission is in position, install torque converter housing bolts and tighten to 30 ft. lbs. (41 N·m).

(8) Install crossmember to frame and lower transmission to install mount on extension to the cross-

member. Tighten all bolts.

(9) Remove the engine support fixture (Fig. 1).

(10) Install oil filler tube and speedometer cable.

(11) Connect throttle rod to transmission lever.

(12) Connect gearshift rod and torque shaft assembly to transmission lever and frame.

When it is necessary to disassemble linkage rods from levers which use plastic grommets as retainers, the grommets should be replaced with new ones. Use a prying tool to force rod from grommet in lever, then cut away old grommet. Use pliers to snap new grommet into lever and rod into grommet.

(13) Place wire connector on the combination backup lamp and neutral/park starter switch.

(14) Connect wiring to lockup solenoid wiring connector at rear of transmission case, if so equipped.

(15) Rotate engine clockwise with socket wrench on vibration dampener bolt, as needed, to install torque converter to drive plate bolts, matching marks made at removal. Tighten to 270 in. lbs. (31 N·m).

(16) Install torque converter access cover.

(17) Install starter motor and cooler line bracket.

(18) Connect cooler lines to transmission fittings.

(19) Install engine to transmission struts, if so equipped.

Tighten bolts holding strut to transmission before strut to engine bolts.

(20) Install transfer case, if so equipped. Refer to "Transfer Case Installation" for procedure.

(21) Replace exhaust system if it was disturbed for clearance.

(22) Carefully guide sliding yoke into extension housing and on the output shaft splines. Align marks made at removal then connect propeller shaft(s) to axle pinion shaft yoke(s).

(23) Adjust gearshaft and throttle linkage.

(24) Refill transmission with MOPAR ATF PLUS (Automatic Transmission Fluid) Type 7176.

NP205 TRANSFER CASE (W250 and W350)

INDEX

	Page		Page
Assembly and Installation of Subassemblies	104	Removal of Transfer Case	101
General Information	100	Specifications	118
Linkage Adjustment	101	Tightening Reference	120
Removal and Disassembly of Subassemblies	101		

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
EXCESSIVE NOISE	(a) Lubricant low. (b) Bearings improperly adjusted worn or damaged. (c) Gears worn or damaged. (d) Misalignment of drive shafts or U-joints.	(a) Fill with proper amount. (b) Adjust or replace bearings. (c) Replace gears. (d) Check alignment of driveshafts.
SHIFTING LEVER DIFFICULT TO MOVE	(a) Control lever bracket or stabilizer loose. (b) Stabilizer bracket to shift lever bolt tight.	(a) Tighten bracket bolts. (b) Tighten bolt finger tight.
LUBRICANT LEAKAGE	(a) Excessive lubricant in case. (b) Vent clogged. (c) Oil seals or gaskets leak. (d) Propeller shaft companion yoke scored where seal contacts. (e) Bearings loose or damaged.	(a) Drain to proper level. (b) Clean vent. (c) Replace seals and gaskets. (d) Replace yoke. (e) Tighten or replace bearings.
OVERHEATING	(a) Lubricant level too high or too low. (b) Bearings adjusted too tight.	(a) Check lubricant level. (b) Check bearing adjustment.
FRONT AXLE DRIVE DISENGAGES	(a) De-clutch lever rod improperly adjusted. (b) Gears or sliding clutch gears worn or damaged. (c) Shift rail poppet ball or spring missing. (d) Improper adjustment of stabilizer and/or control rods.	(a) Adjust de-clutch rod. (b) Replace gears. (c) Replace poppet ball and/or spring. (d) Adjust rods, refer to paragraphs—Linkage Adjustments.
BACKLASH	(a) Companion yoke loose. (b) Transfer case loose on mounting brackets. (c) Worn parts.	(a) Tighten yoke. (b) Tighten brackets and case. (c) Replace all worn parts.

GENERAL INFORMATION

Safety goggles should be worn at all times when working on the NP205 transfer case.

The NP205 transfer case (Fig. 1) is a two-speed unit which provides speed reduction and transmits power from the transmission to the front drive axle as well as the conventional rear axle.

From the transfer case power is delivered to both front and rear axles by conventional propeller shafts. Contained within the transfer case are five constant-

mesh helical gears and shafts mounted on ball and needle roller bearings. These gears provide two speed ranges: A high range with a 1 to 1 ratio for highway driving and a low range with a reduction of 1.96 to 1 for off the road or heavy operation. It is possible to disengage the drive to the front axle when maximum traction is not required.

Sliding clutch gears in the transfer case are controlled by a single shift lever in the vehicle.

SERVICE PROCEDURES

Removal Of Transfer Case

- (1) Remove drain plug and allow case to completely drain, replace plug.
- (2) Disconnect speedometer cable.
- (3) Disconnect the propeller shafts. Secure each shaft out of the way. Do not allow shafts to hang.
- (4) Remove shift rod from shift rail link.
- (5) Using a suitable jack, support transfer case

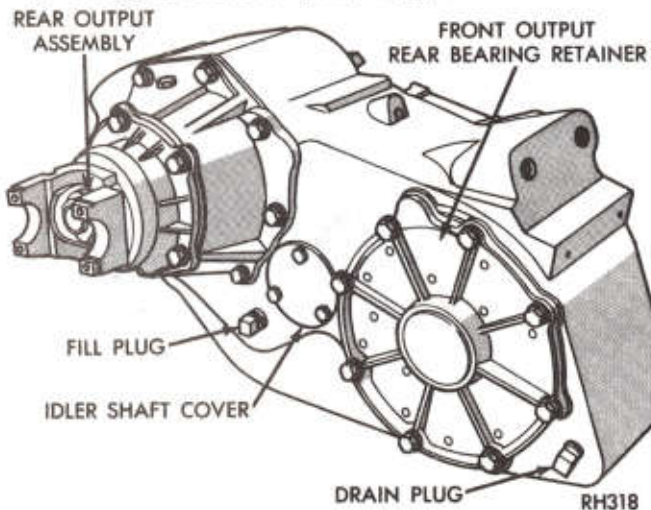
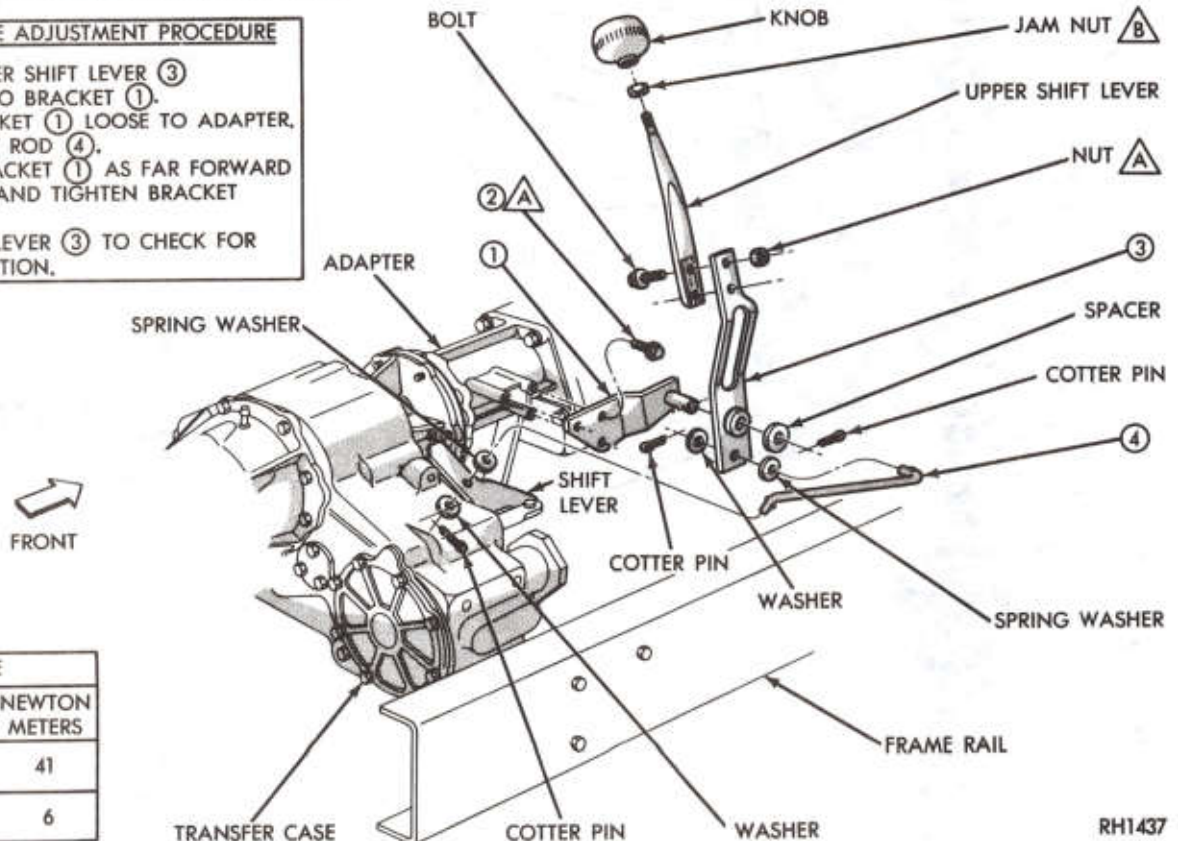


Fig. 1—Transfer Case Assembly

SHIFT LINKAGE ADJUSTMENT PROCEDURE

1. INSTALL LOWER SHIFT LEVER (3) TO BRACKET (1).
2. MOUNT BRACKET (1) LOOSE TO ADAPTER.
3. INSTALL SHIFT ROD (4).
4. POSITION BRACKET (1) AS FAR FORWARD AS POSSIBLE AND TIGHTEN BRACKET SCREW (2).
5. CYCLE SHIFT LEVER (3) TO CHECK FOR PROPER FUNCTION.



TORQUE		
LET.	POUNDS	NEWTON METERS
A	30 FT.	41
B	55 IN.	6

while removing attaching bolts.

- (6) Lower unit to floor, remove from under the vehicle.

REMOVAL AND DISASSEMBLY OF SUBASSEMBLIES (Fig. 3)

- (1) Loosen rear output yoke.
- (2) Remove rear output shaft housing retainer.
- (3) Remove yoke previously loosened, discard nut. Remove shaft assembly.
- (4) Remove snap ring and discard.
- (5) Remove thrust washer and washer pin.
- (6) Remove tanged washer. Remove gear, remove needle bearings (32 per row) remove spacer and 2nd row of needle bearings.
- (7) Remove tanged thrust washer.
- (8) Remove pilot rollers from shaft (15 rollers).
- (9) Remove pilot roller retainer ring and discard. Remove roller washer.
- (10) Remove oil seal retainer, remove ball bearing, speedometer gear and spacer. Discard all gaskets. Press out bearing.

Fig. 2—NP205 Transfer Case Controls and Adjustment

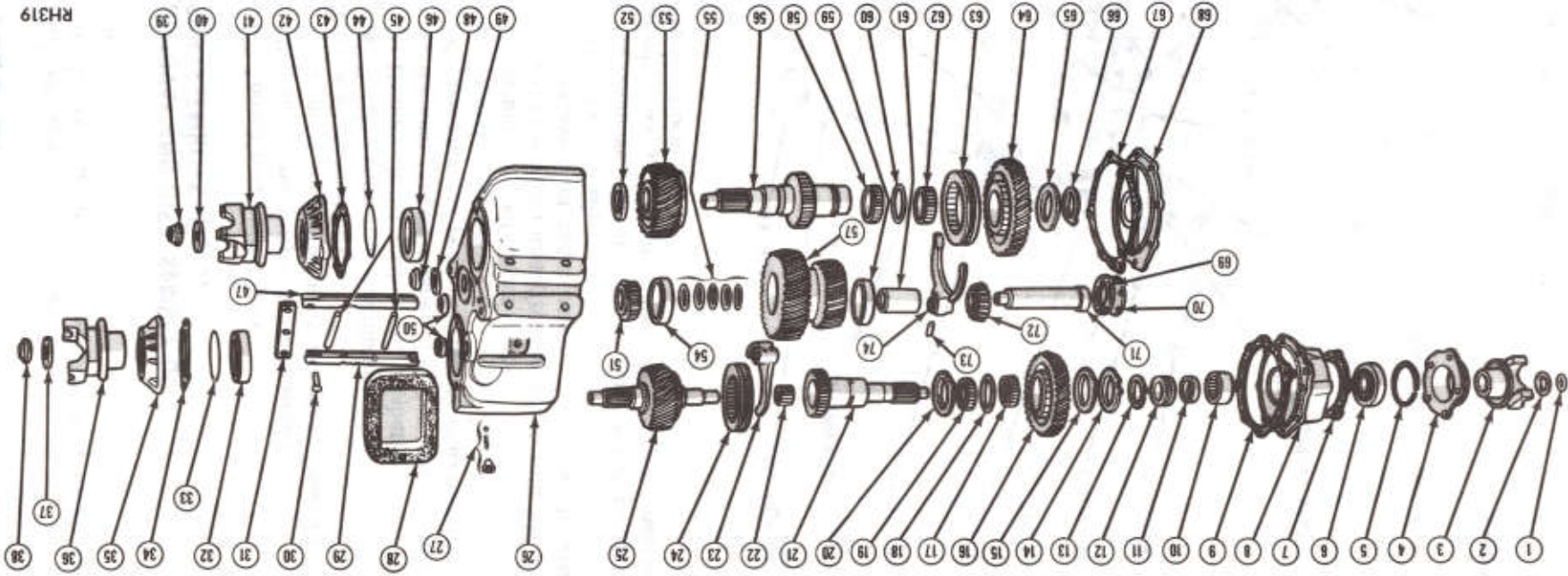


Fig. 3—NP205 Transfer Case

- LEGEND FIG. 3
- 16. Input Gear
 - 17. Needle Bearings
 - 18. Washer
 - 19. Needle Bearings
 - 20. Washer
 - 21. Input Shaft
 - 22. Needle Bearing
 - 23. Shift Fork
 - 24. Sliding Clutch
 - 25. Rear Wheel Output Shaft
 - 26. Case
 - 27. Poppet Plug, Spring and Ball
 - 28. P.T.O. Gasket and Cover
 - 29. Shift Rod
 - 30. Shift Rod Link Clevis Pin
 - 31. Shift Rod Link
 - 32. Bearing
 - 33. Snap Ring
 - 34. Gasket
 - 35. Oil Seal
 - 36. Adapter
 - 37. Nut
 - 38. Washer
 - 39. Yoke
 - 40. Washer
 - 41. Retainer
 - 42. Gasket
 - 43. Snap Ring
 - 44. Interlocks
 - 45. Bearing
 - 46. Shift Rod
 - 47. Shift Rod Link
 - 48. Nut
 - 49. Washer
 - 50. Oil Seals
 - 51. Bearing
 - 52. Thrust Washer
 - 53. Front Wheel Hi Gear
 - 54. Bearing Cone
 - 55. Shims
 - 56. Front Wheel Output Shaft
 - 57. Idler Gear Assembly
 - 58. Needle Bearings
 - 59. Bearing Cone
 - 60. Spacer
 - 61. Spacer
 - 62. Needle Bearings
 - 63. Sliding Clutch
 - 64. Gear
 - 65. Thrust Washer
 - 66. Snap Ring
 - 67. Gasket
 - 68. Retainer and Bearing Assembly
 - 69. Gasket
 - 70. Idler Gear Cover
 - 71. Idler Gear Shaft
 - 72. Bearing
 - 73. Fork, Lock Pin
 - 74. Shift Fork

- 1. Nut
- 2. Washer
- 3. Yoke
- 4. Retainer and Seal Assembly
- 5. Snap Ring
- 6. Bearing
- 7. Gasket
- 8. Retainer
- 9. Gasket
- 10. Spacer
- 11. Speedometer Gear
- 12. Snap Ring
- 13. Thrust Washer
- 14. Thrust Washer
- 15. Thrust Washer

- 48. Nut
- 49. Washer
- 50. Oil Seals
- 51. Bearing
- 52. Thrust Washer
- 53. Front Wheel Hi Gear
- 54. Bearing Cone
- 55. Shims
- 56. Front Wheel Output Shaft
- 57. Idler Gear Assembly
- 58. Needle Bearings
- 59. Bearing Cone
- 60. Spacer
- 61. Spacer
- 62. Needle Bearings
- 63. Sliding Clutch
- 64. Gear
- 65. Thrust Washer
- 66. Snap Ring
- 67. Gasket
- 68. Retainer and Bearing Assembly
- 69. Gasket
- 70. Idler Gear Cover
- 71. Idler Gear Shaft
- 72. Bearing
- 73. Fork, Lock Pin
- 74. Shift Fork

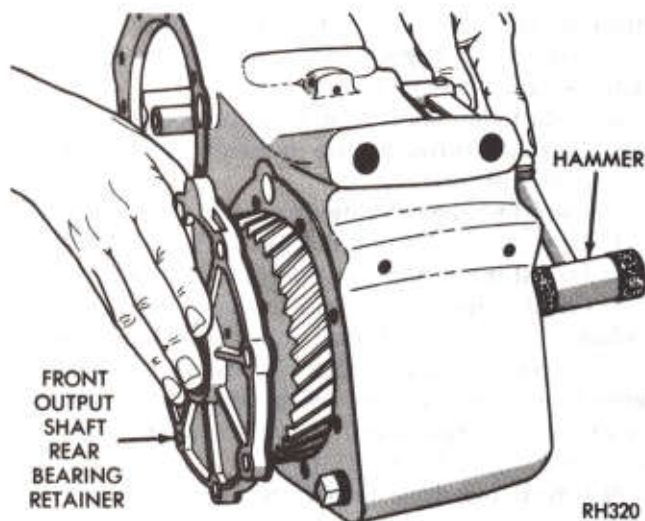


Fig. 4—Remove Front Output Shaft Assembly

Input, Front Output, and Idler Gear

- (1) Remove front output yoke. Remove idler gear shaft nut. Discard all nuts.
- (2) Remove front output bearing retainer (Fig. 1).
- (3) Remove front input bearing retainer and rear input shaft bearing retainer. Remove PTO cover.
- (4) Remove idler shaft cover (Fig. 1).
- (5) Remove the two poppet nuts.
- (6) Remove the two poppet springs and using a magnet, remove the two poppet balls.
- (7) Remove front output shaft, gear assembly and bearing (Fig. 4).
- (8) Remove snap ring (Fig. 5).
- (9) Remove thrust washer and thrust washer pin. Remove gear and needle bearings (32 per row) and spacer.
- (10) Remove cup plugs on top of case using a 1/4 inch punch.
- (11) Position both shift rails in neutral.

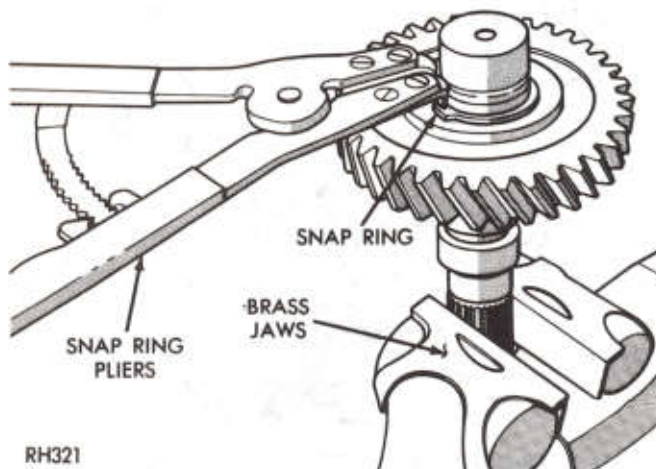


Fig. 5—Front Output Shaft Snap Ring

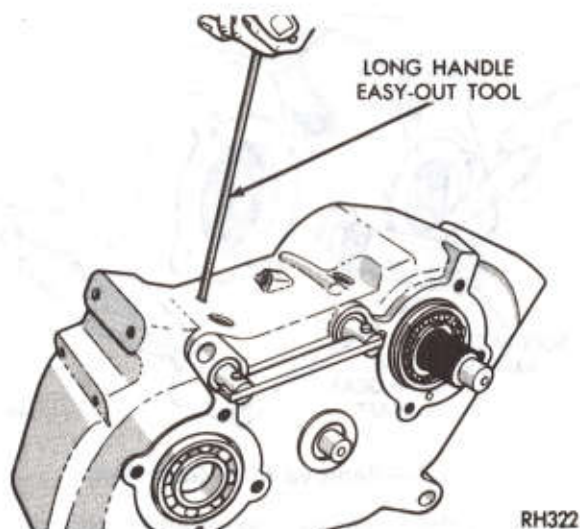


Fig. 6—Remove Shift Fork Pins

- (12) Using a long-handle easy-out tool, remove shift fork pins (Fig. 6).
- (13) Remove clevis pins, remove shift rail link.
- (14) Remove shift rails, upper rail (range) first, then lower (4 wheel) (Fig. 7).
- (15) Remove forks and sliding clutches.
- (16) Remove front output high gear, washer, and bearing.
- (17) Remove input gear and bearing.
- (18) Using plastic hammer, remove idler gear shaft (Fig. 8).
- (19) Tilt case at 45 degree angle, roll idler gear to front shaft hole and remove. Note and record number of shims for reassembly.
- (20) Remove two bearing cups from idler gear.
- (21) Remove two interlock pins from inside of case (upward) toward PTO opening.
- (22) If necessary to replace front output shaft rear

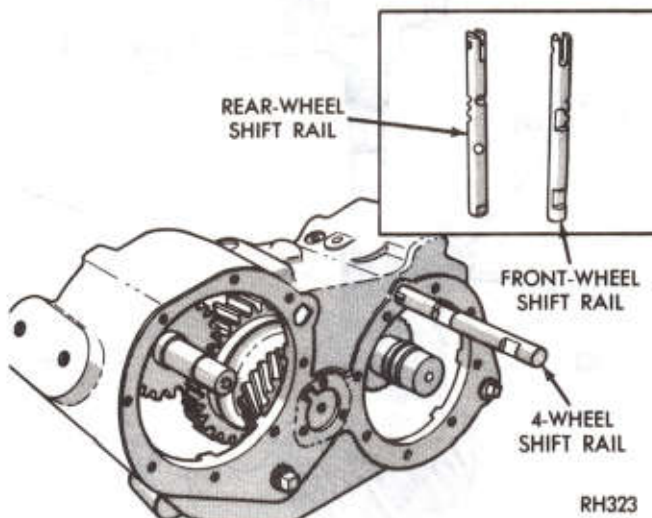


Fig. 7—Remove or Install Shift Rails

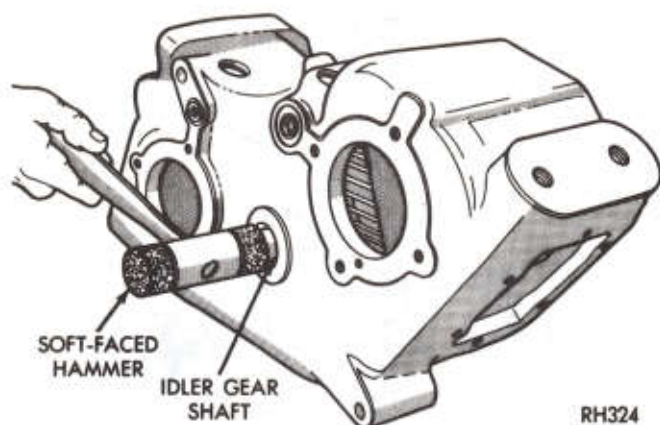


Fig. 8—Remove Idler Gear Shaft

bearing, replace bearing and retainer assembly. **Do not press new bearing in old retainer.**

(23) Remove rail seals if needed. Dispose of all gaskets.

ASSEMBLY AND INSTALLATION OF SUBASSEMBLIES

Input, Front Output Gear, and Idler Gear Assemblies

(1) Using arbor or hydraulic press, install two bearing cups in idler gear (Fig. 9).

(2) Assemble the two bearing cones, spacer, shims and idler gear on a dummy shaft (Tool DD1272) with bore up. End play should be .000 to .002 inch loose (Fig. 9).

(3) Press the two rail seals into case. These seals are wiper type and should be installed with lip outward.

(4) Install idler gear assembly with dummy shaft

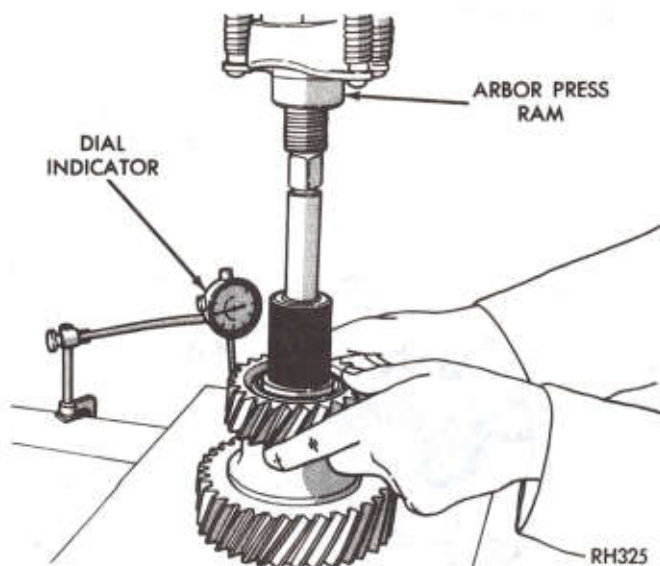


Fig. 9—Press in Bearing Caps and Check End Play

into case through front output bore, large end first. Tilt case at 45 degree angle to facilitate bearing installation at boss (Fig. 10).

(5) Install idler shaft from large bore side and drive dummy shaft through, use a heavy, soft hammer (plastic or leather).

(6) Install washer and **new** locknut. Check end play and free rotation. Tighten nut to 150 ft. lbs. (203 N-m).

(7) Install input and front output shaft bearings.

(8) Check input and front output bearing seals, replace if necessary. Install input and front output bearing retainer assemblies. Check with gasket to determine if one or two are needed. Dip bolts into sealant before installing. Install retainers with oil drain slot aligning with drain hole.

(9) Install interlock pins from large bore or PTO opening.

(10) Install input gear assembly.

(11) Install front wheel Hi gear and washer on front output shaft in case. Install clutch gear on the shaft.

(12) Start front wheel shift rail into case from back, slotted end first, poppet notches up (Fig. 7).

(13) Install sliding clutch onto fork (long end inward), then place over front output shaft. Slide onto clutch gear and position to receive rail. Push rail through to neutral position.

(14) Start range rail into case from back, poppet notches up.

(15) Install sliding clutch onto fork, place over input shaft. Slide onto clutch gear and position to receive range rail. Push rail through to neutral position.

(16) Install **new** lock pins through holes at top of case, into forks and drive to seat.

(17) Install two rows of 32 needles each separated by spacer in front low output gear. Retain with sufficient amount of grease. Place front output shaft

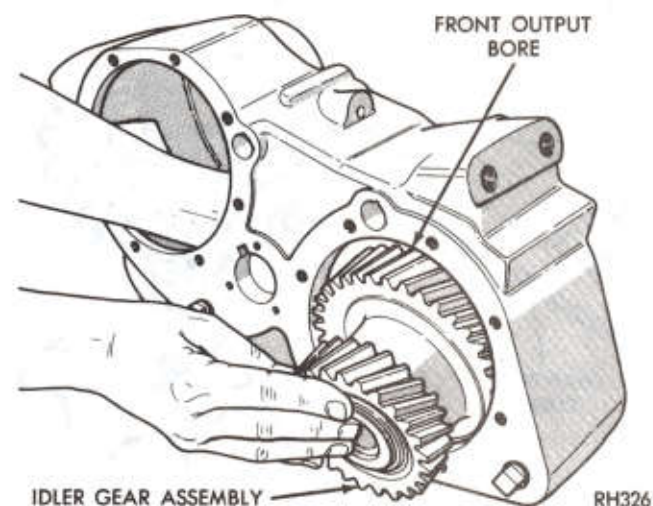


Fig. 10—Install Idler Gear Assembly

in soft-jawed vise, yoke end down. Install front lower output gear over shaft with clutch gear facing down. Install thrust washer pin, thrust washer and **new** snap ring. Position snap ring with opening opposite pin. Place front output shaft yoke in position in retainer. Place case on bench yokes down. Line up output shaft yoke, washer, and front wheel high gear with bearing bore. Lock high gear in place by putting fork in 4-wheel high range. Insert front output shaft and low gear assembly through front wheel high gear washer and bearing. Turn yoke until splines mate with shaft and mesh. Turn case over and install washer and **new** nut on front output shaft. Tighten nut to 130 ft. lbs. (176 N·m).

(18) Clean and grease rollers in front output rear bearing retainer. Install onto case using one gasket. Dip bolts in sealant. Tighten to 40 ft. lbs. (54 N·m).

(19) Install PTO cover and gasket. Tighten bolts to 15 ft. lbs. (20 N·m).

(20) Install idler shaft cover and gasket. Tighten bolts to 25 ft. lbs. (34 N·m).

(21) Install poppet balls, springs, gaskets and nuts. Tighten nuts to 20 ft. lbs. (27 N·m).

Rear Output Retainer Assembly (Fig. 11)

(1) Install rear output low gear needle bearings, 32 per row, separated by a spacer. Use sufficient amount of grease to retain needle bearings.

(2) Install thrust washer onto rear output shaft, tang down in clutch gear groove. Install needled gear onto shaft over washer, clutch gear facing down. Install second thrust washer with tab pointing up and away from gear. Install washer pin. Install large thrust washer over shaft and pin; rotate to fit tab into slot, 90 degrees way from pin. Install **new** snap ring, tap to seat. Check end play. End play should be .002 to .027 inch.

(3) Grease pilot bore of rear output shaft and install

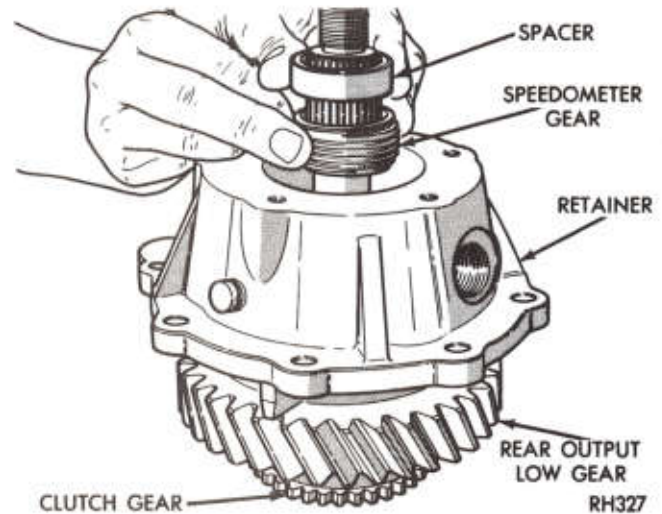


Fig. 11—Rear Output Retainer and Gear Assembly

needle bearings (fifteen).

(4) Install needle bearing thrust washer and **new** snap ring.

(5) Clean, grease, and install needle bearing in retainer housing.

(6) Install retainer onto output shaft assembly, install speedometer gear and spacer, install bearing.

(7) Install bearing onto rear retainer assembly with one or two gaskets, depending on clearance. Tighten bolts to 40 ft. lbs. (54 N·m)

(8) Position range rail in high, install the retainer assembly on transfer case. Tighten bolts to 40 ft. lbs. (54 N·m). Install the yoke and **new** nut and tighten 130 ft. lbs. (176 N·m).

(9) Install drain and filler plugs. Install and seal cup lugs at rail pin holes.

(10) Install shift rail cross link.

(11) Fill transfer case with proper lubrication (See "Group 0 Lubrication"), to bottom of fill plug hole.

NP241 TRANSFER CASE

INDEX

	Page		Page
Cleaning and Inspection	115	Rear Retainer	114
Disassembly of Transfer Case	110	Removal from Vehicle	109
General Information	105	Service Diagnosis	108
Identification	106	Service in Vehicle	107
Installation into Vehicle	109	Specifications	119
Linkage Adjustment	106	Subassembly Overhaul	112
Lubrication	106	Tightening Reference	120

GENERAL INFORMATION

The NP241 is a part-time transfer case with a built-in low-range reduction gear system. It has three operating ranges plus a Neutral position. The low-range system provides a gear reduction ratio for

increased low-speed torque capability.

The NP241 has three operating ranges which are: Two-wheel-drive high, four-wheel-drive high and four-wheel-drive low. The four-wheel-drive operating

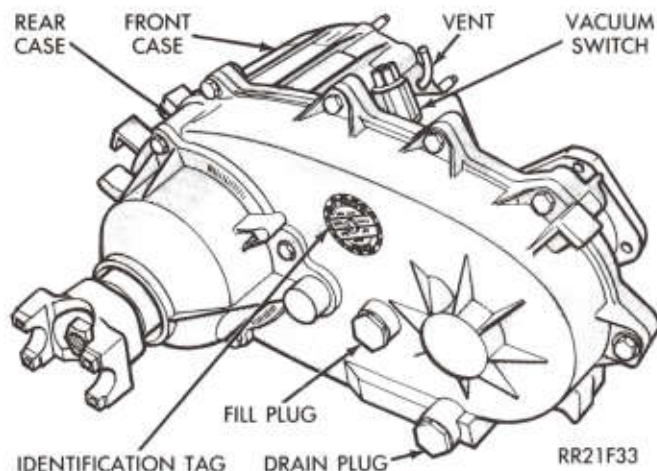


Fig. 1—NP241 Transfer Case

ranges are undifferentiated.

Two-wheel-drive range is used for on-road, highway operation. The four-wheel-drive ranges are for off-road operation or when the vehicle is driven on paved road surfaces covered by snow, ice or similar low-traction elements.

Identification

A circular identification tag (Fig. 1) is attached to the rear case of each Model 241 transfer case. The

identification tag provides the transfer case model number, assembly number, serial number, and low-range ratio.

The transfer case serial number also represents the date of build. For example, a serial number of 2-9-88 would represent February 9, 1988.

Transfer case operating ranges are selected with a floor-mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable linkage rod (Fig. 2). A straight line shift pattern is used. Range positions are marked on the gearshift lever knob.

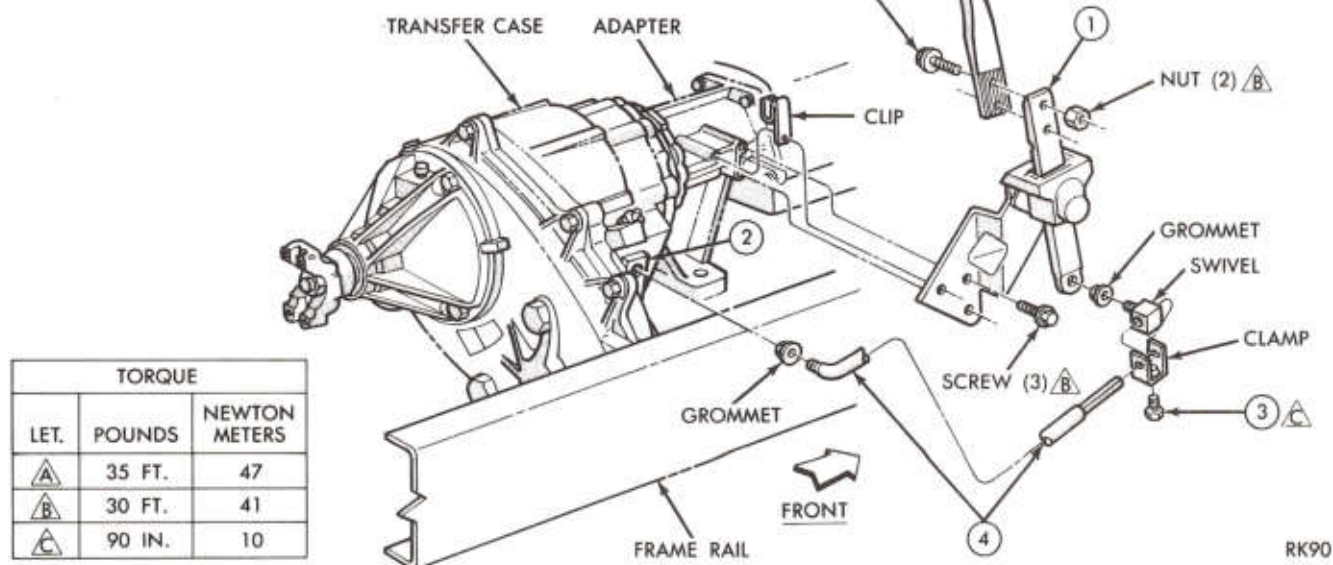
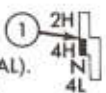
A synchronizer assembly in the transfer case allows the unit to be shifted between the two and four-wheel-high ranges while the vehicle is in motion.

LUBRICATION

The NP241 transfer case lubricant should be changed at the intervals specified in the Maintenance Schedule. When adding lubricant to or refilling the transfer case after service, used MOPAR ATF PLUS (type 7176) or DEXRON II automatic transmission fluid. Do not use any type of antifriction type additives or similar substance. Use the specified oil only. Refer to the Service-In-Vehicle section for lubricant change procedures and fill level.

SHIFT LINKAGE ADJUSTMENT PROCEDURE

1. POSITION SHIFT LEVER **(1)** AGAINST 4H GATE.
2. PLACE SHIFT LEVER **(2)** IN 4H POSITION—(VERTICAL).
3. INSTALL SHIFT ROD **(4)** AND TORQUE SCREW **(3)**.
4. CYCLE SHIFT LEVER **(1)** TO CHECK FOR PROPER FUNCTION.



TORQUE		
LET.	POUNDS	NEWTON METERS
A	35 FT.	47
B	30 FT.	41
C	90 IN.	10

Fig. 2—NP241 Transfer Case Controls and Linkage Adjustment

SERVICE DIAGNOSIS

Before attempting to repair a suspected transfer case malfunction, check all other driveline components beforehand. The actual cause of a problem may be related to such items as the front hubs, axles, propeller shafts, wheels and tires, transmission, or clutch instead. If all other driveline components are in good condition and operating properly, refer to the Service Diagnosis chart for further information.

SERVICE IN VEHICLE

Changing Lubricant

- (1) Raise vehicle.
- (2) Position drain pan under transfer case.
- (3) Remove drain and fill plugs and drain lubricant completely.
- (4) Install drain plug. Tighten plug to 40 ft. lbs. (54 N·m).
- (5) Remove drain pan.
- (6) Fill transfer case to bottom edge of fill plug opening with MOPAR ATF PLUS (type 7176) or DEXRON II automatic transmission fluid.
- (7) Install fill plug. Tighten plug to 40 ft. lbs. (54 N·m).
- (8) Lower vehicle.

Speedometer Gear, Shaft Seal, Rear Bearing and Retainer Replacement.

The front and rear yokes, outputs shaft seals, rear retainer and bearing, and speedometer drive gear can all be serviced with the transfer case in the vehicle. The following combined procedure outlines removal and installation of these components:

Removal

- (1) Raise vehicle.
- (2) Remove fill and drain plugs and drain oil from

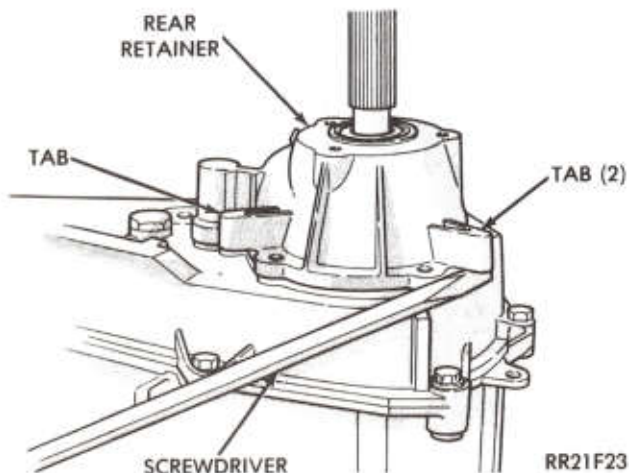


Fig. 1—Pry Rear Retainer

transfer case.

(3) Mark propeller shaft and transfer case yoke for assembly alignment reference.

(4) Disconnect propeller shaft. Secure shaft to the underside vehicle.

(5) Remove and discard transfer case yoke retaining nut and yoke seal washer. Use Tool C-3281 to hold yoke while removing nut. Remove yoke.

(6) Remove retainer seal (if seal or bushing is to be replaced) using suitable tool.

(7) Install a new seal, if old seal was removed.

(8) Removed speedometer gear from rear retainer.

(9) Mark rear retainer for assembly alignment reference.

(10) Remove retainer attaching bolts and remove retainer. Pry retainer with screwdrivers to remove it (Fig. 1).

(11) Remove rear retainer (Fig. 2). Remove speedometer drive gear, if necessary.

(12) Completely clean off old RTV sealant.

(13) If the retainer or bearing are to be replaced, remove bearing retainer snap ring from rear retainer and remove bearing (See "Rear Retainer" at end of this group).

Installation

(1) Install rear output bearing in rear retainer and install snap ring.

(2) Apply a 1/8 inch bead of RTV sealant or equivalent to mating surface of rear retainer.

(3) Align retainer case reference marks and install rear retainer on case.

(4) Install and tighten rear retainer attaching bolts to 18 ft. lbs. (24 N·m).

(5) Install output shaft seal (if required).

(6) Install yoke, a new yoke seal washer and yoke nut. Tighten nut to 110 ft. lbs. (149 N·m).

(7) Install speedometer driven gear.

(8) Install drain plug. Tighten plug to 40 ft. lbs.

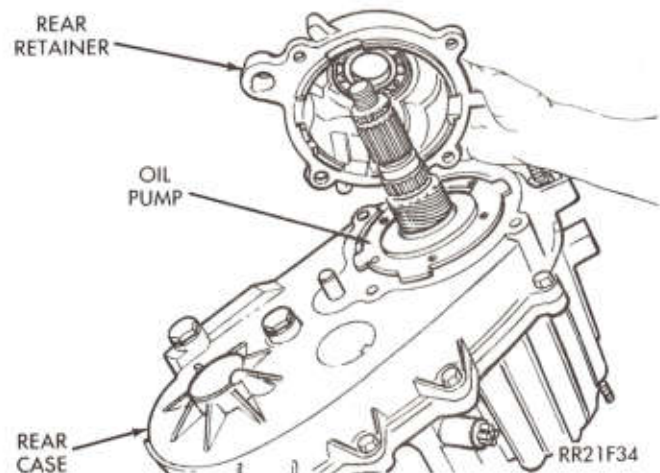


Fig. 2—Rear Retainer Removed

(54 N·m).

(9) Fill transfer case to edge of fill plug opening with MOPAR ATF PLUS (type 7176) or DEXRON II automatic transmission fluid.

(10) Install fill plug. Tighten plug to 40 ft. lbs.

(54 N·m).

(11) Connect propeller shaft. Tighten clamp strap bolts to 170 in. lbs. (19 N·m).

(12) Lower vehicle.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
TRANSFER CASE DIFFICULT TO SHIFT OR WILL NOT SHIFT INTO DESIRED RANGE	(a) Vehicle speed too great to permit shifting. (b) If vehicle was operated for extended period in 4H mode on dry paved surface, driveline torque load may cause difficulty. (c) Transfer case external shift linkage binding. (d) In sufficient or incorrect lubricant. (e) Internal components binding, worn or damaged.	(a) Stop vehicle and shift into desired range. Or reduce speed to 3-4 km/h (2-3 mph) before attempting to shift. (b) Stop vehicle, shift transmission to neutral, shift transfer case to 2H mode and operate vehicle on 2H on dry paved surfaced. (c) Lubricate, repair or replace linkage, or tighten loose components as necessary. (d) Drain and refill to edge of fill hole with MOPAR ATF PLUS (Type 7176) or DEXRON II Automatic Transmission Fluid. (e) Disassemble unit and replace worn or damaged components as necessary.
TRANSFER CASE NOISY IN ALL DRIVE MODES	(a) Insufficient or incorrect lubricant.	(a) Drain and refill to edge of fill hole with MOPAR ATF PLUS (Type 7176) or DEXRON II Automatic Transmission Fluid. Check for leaks and repair if necessary. If unit is still noisy after drain and refill, disassembly and inspection may be required to locate source of noise.
NOISY IN—OR JUMPS OUT OF FOUR-WHEEL-DRIVE LOW RANGE	(a) Transfer case not completely engaged in 4L position. (b) Shift linkage loose or binding. (c) Range fork cracked, inserts worn, or fork is binding on shift rail. (d) Annulus gear or lockplate worn or damaged.	(a) Stop vehicle, shift transfer case to Neutral, then shift back into 4L position. (b) Tighten, lubricate, or repair linkage as necessary. (c) Disassemble unit and repair as necessary. (d) Disassemble unit and repair as necessary.
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	(a) Transfer case overfilled. (b) Vent closed or restricted. (c) Output shaft seals damaged or installed correctly.	(a) Drain to correct level. (b) Clear or replace vent if necessary. (c) Replace seals. Be sure seal lip faces interior of case when installed. Also be sure yoke seal surfaces are not scored or nicked. Remove scores and nicks with fine sandpaper or replace yoke(s) if necessary.
ABNORMAL TIRE WEAR	(a) Extended operation on dry hard surface (paved) roads in 4H range.	(a) Operate in 2H on hard surface (paved) roads.

TRANSFER CASE REMOVAL

- (1) Raise vehicle.
- (2) Drain lubricant from transfer case.
- (3) Mark transfer case front and rear output shaft yokes and propeller shafts for assembly alignment reference.
- (4) Disconnect speedometer cable and vacuum switch hoses.
- (5) Disconnect shift lever link from operating lever.
- (6) Place support stand under transmission and remove rear crossmember.
- (7) Mark transfer case front and rear output shaft yokes and propeller shafts or assembly alignment reference.
- (8) Disconnect front and rear propeller shafts at transfer case yokes. Secure shafts to frame rails with wire. **DO not allow shafts to hang.**
- (9) Remove transfer case-to-transmission nuts.
- (10) Move transfer case assembly rearward until free of transmission output shaft and remove assembly.
- (11) Remove all gasket material from rear of transmission adapter housing.

TRANSFER CASE INSTALLATION

- (1) Apply Permatex No. 3 sealer, or equivalent to both sides of transfer case-to-transmission gasket and position gasket on transmission.
- (2) Align and install transfer case assembly on transmission. Be sure transfer case input gear splines are aligned with transmission output shaft. Align splines by rotating transfer case rear output shaft yoke if necessary.
Do not install any transfer case attaching nuts until the transfer case is completely seated against the transmission.
- (3) Align and install transfer case attaching nuts. Tighten nuts to 35 ft. lbs. (47 N·m).
- (4) Install rear crossmember and remove transmission support stand.
- (5) Align and connect propeller shafts.
- (6) Connect speedometer cable and vacuum switch hoses.
- (7) Connect shift lever to operating lever. Tighten locknut to 90 in. lbs. (10 N·m).
- (8) Fill transfer case with MOPAR ATF PLUS (type 7176) or DEXRON II type oil.
- (9) Lower vehicle.

TRANSFER CASE DISASSEMBLY AND ASSEMBLY

(1) Disassemble and assemble transfer case in the following sequence, as shown:

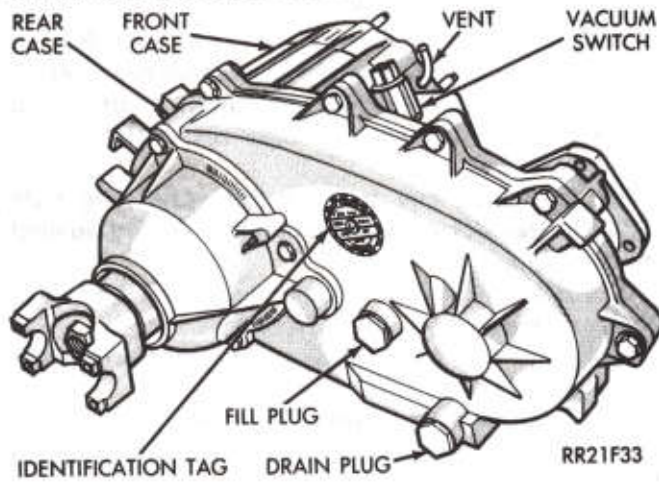


Fig. 1—Transfer Case Removed

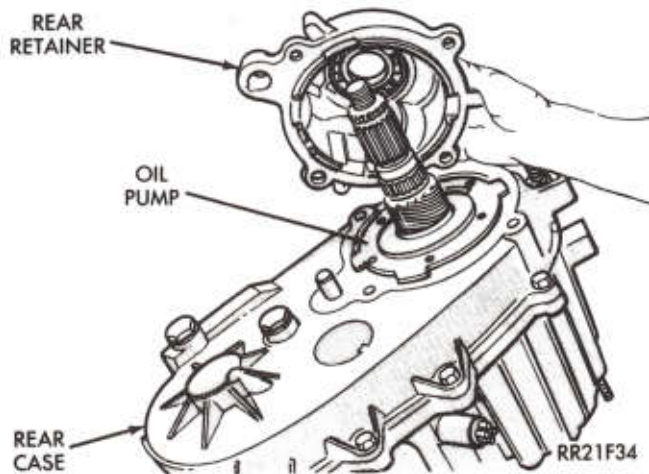


Fig. 2—Rear Retainer

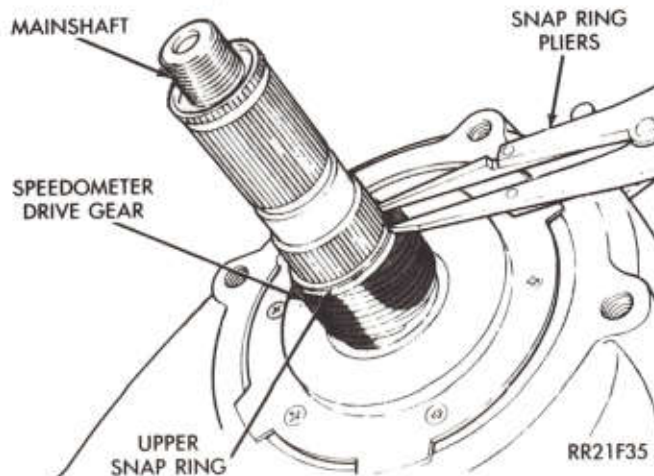


Fig. 3—Upper Snap Ring And Speedometer Drive Gear

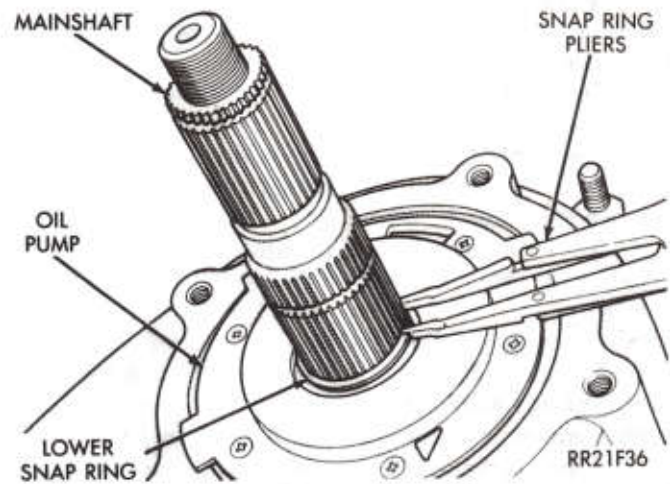


Fig. 4—Lower Snap Ring

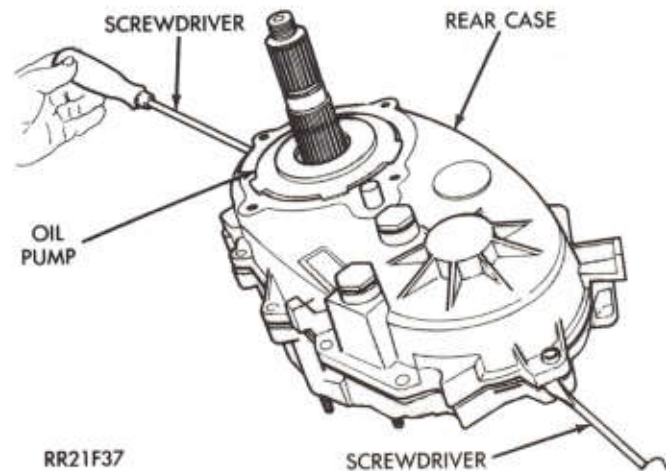


Fig. 5—Pry Rear Case

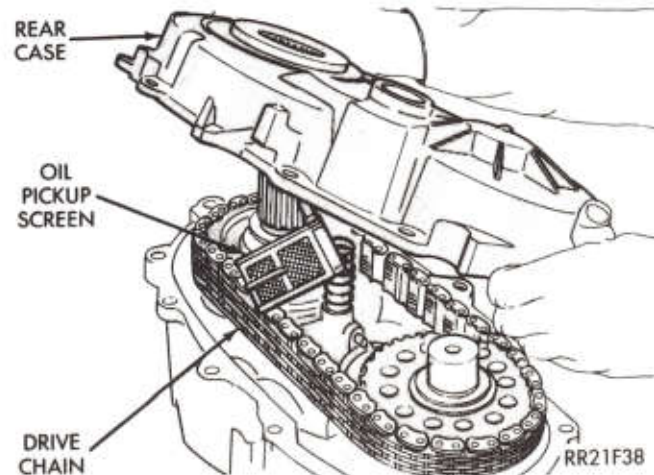


Fig. 6—Remove or Install Rear Case

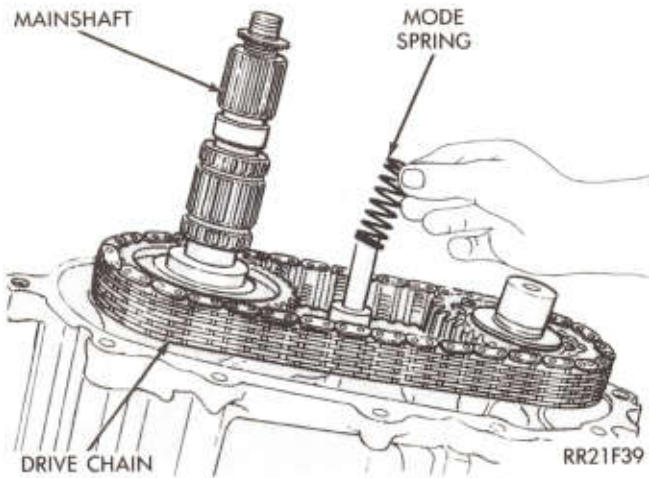


Fig. 7—Mode Spring

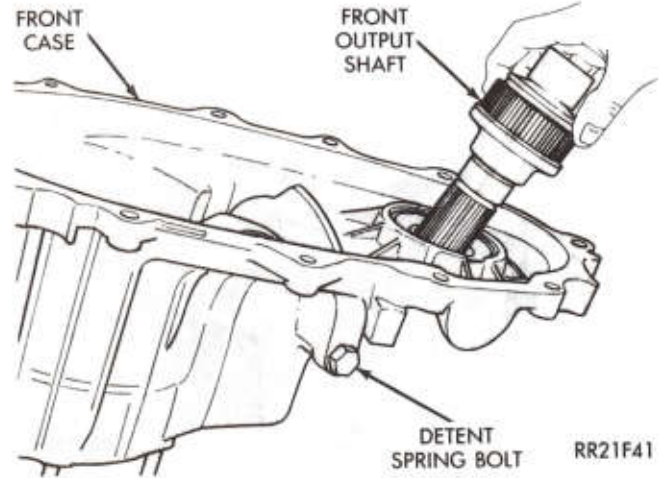


Fig. 10—Front Output Shaft

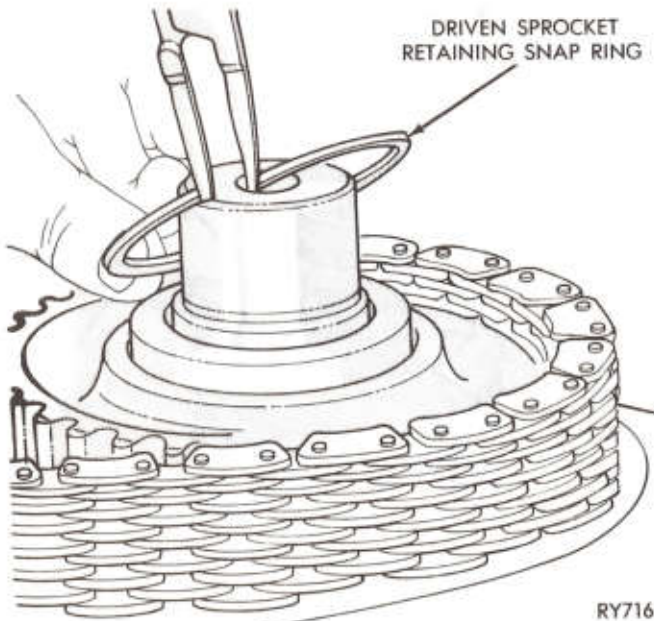


Fig. 8—Driven Sprocket Snap Ring

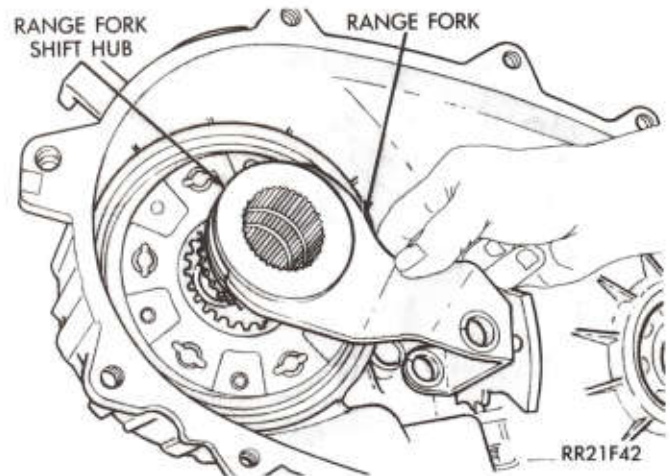


Fig. 11—Range Fork and Hub

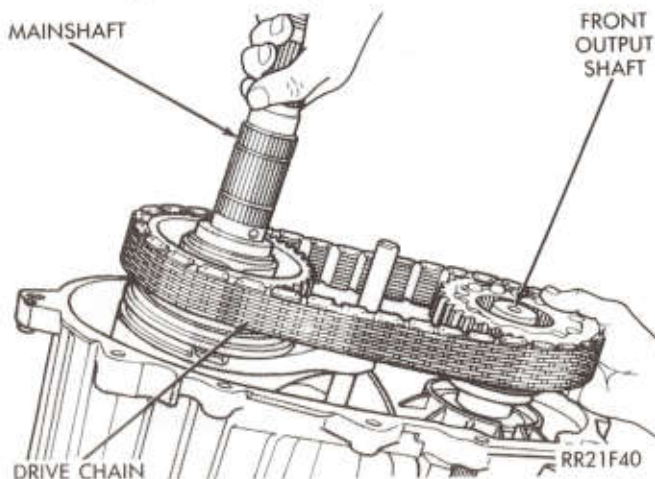


Fig. 9—Remove or Install Sprockets and Drive Chain

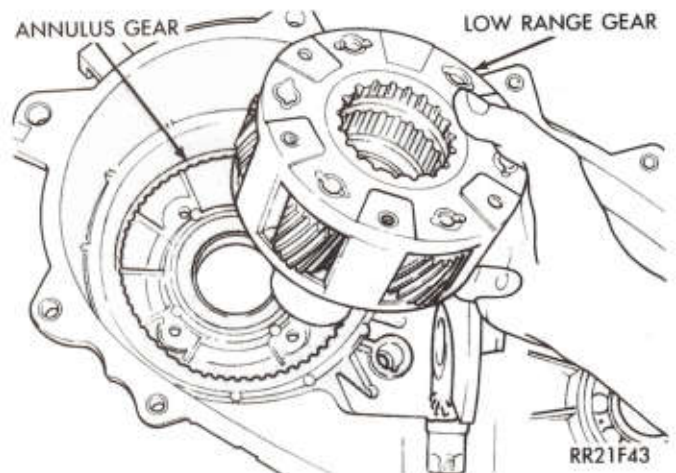


Fig. 12—Low Range Gear

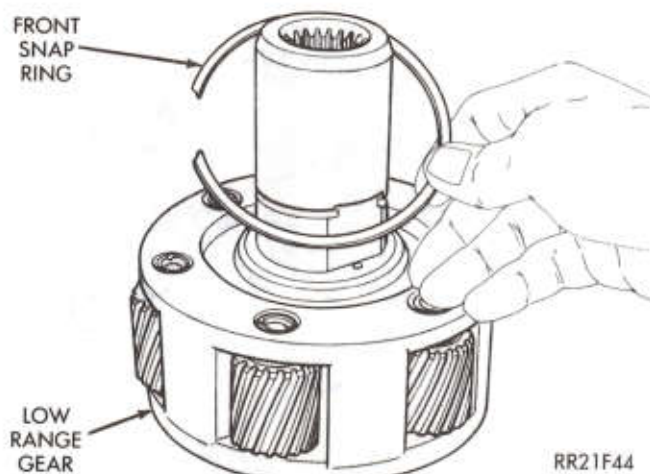


Fig. 13—Low Range Gear Snap Ring

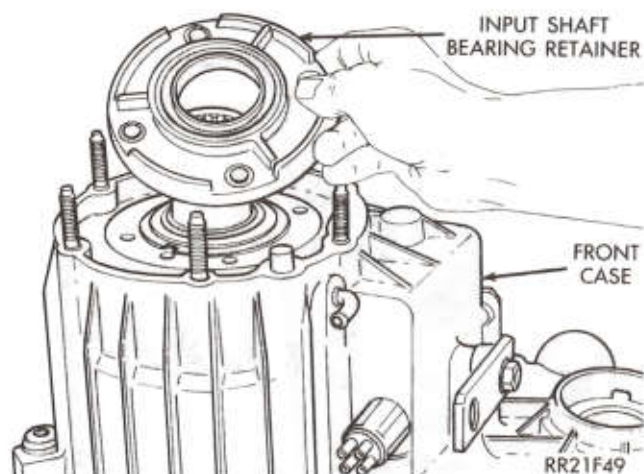


Fig. 14—Input Shaft Bearing Retainer

SUBASSEMBLY OVERHAUL

Input Gear Bearing

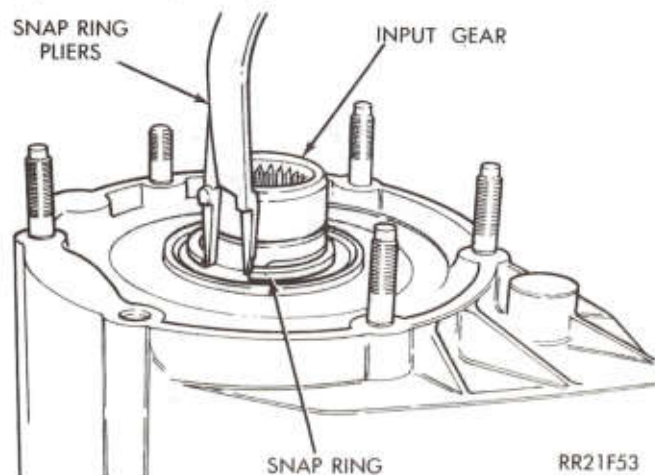


Fig. 1—Input Gear Snap Ring

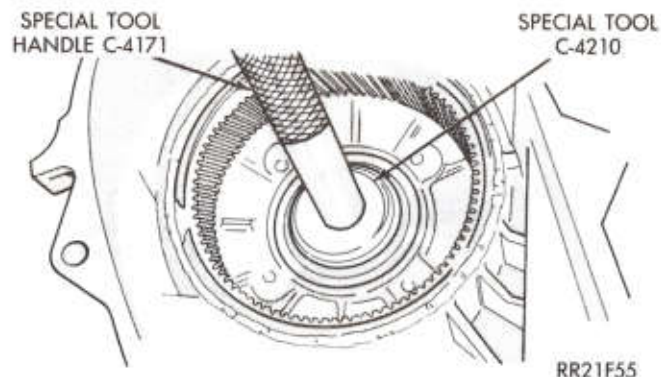


Fig. 2—Remove or Install Input Gear Bearing

Mainshaft Assembly

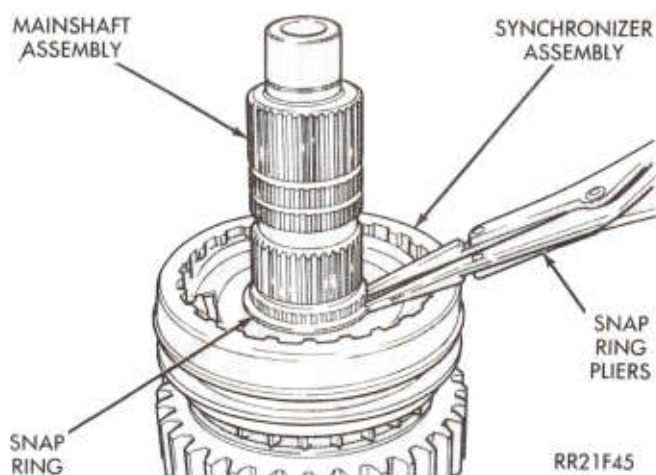


Fig. 1—Synchronizer Snap Ring

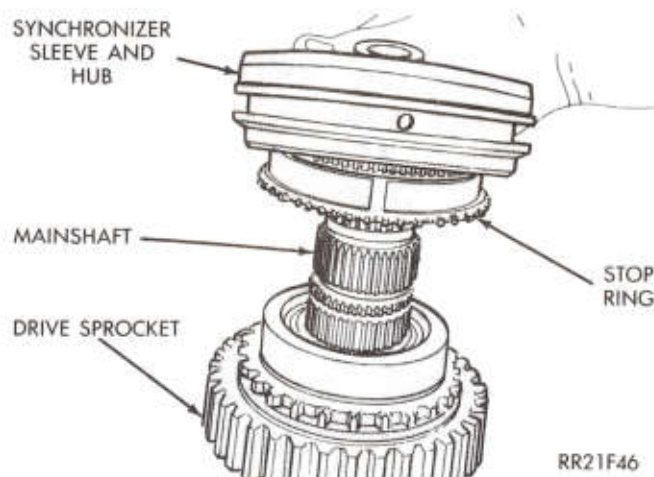


Fig. 2—Synchronizer Assembly

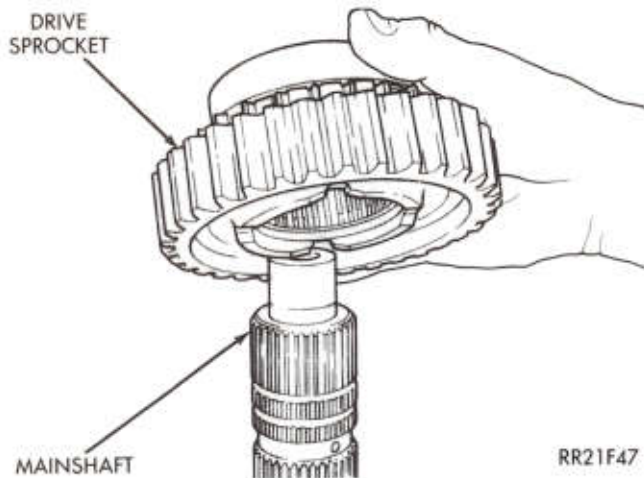


Fig. 3—Drive Sprocket

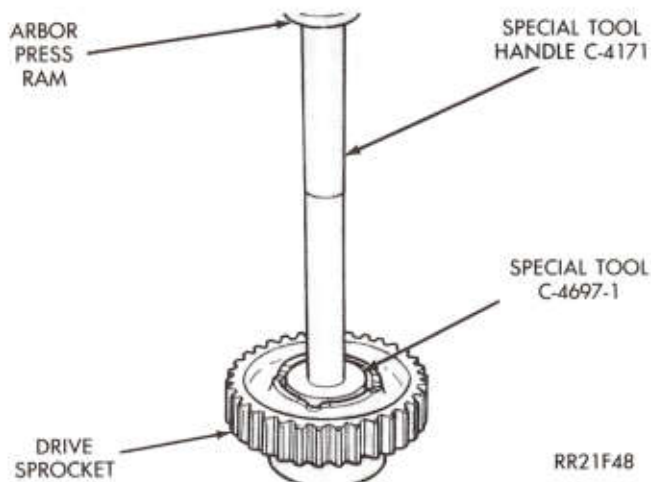
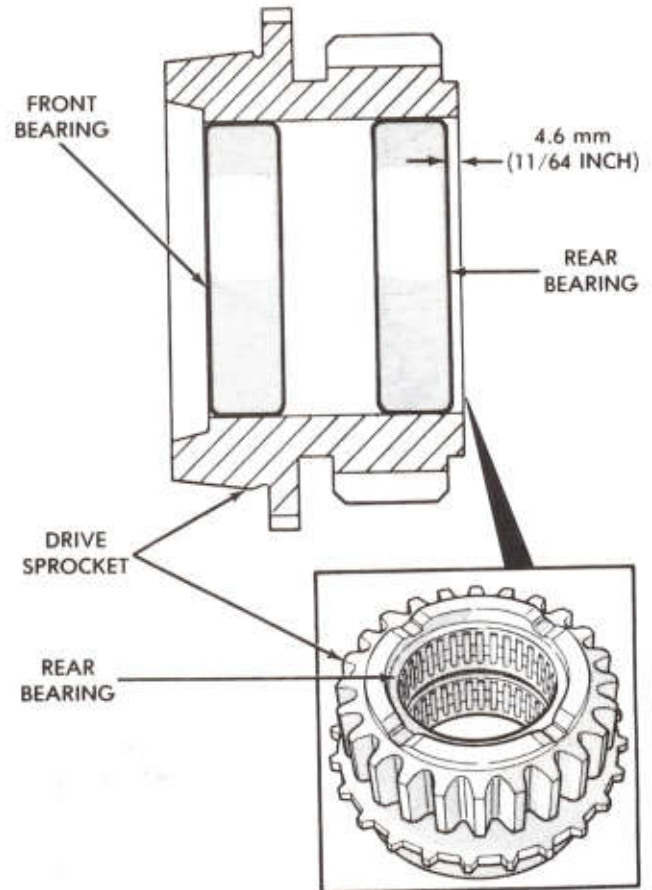


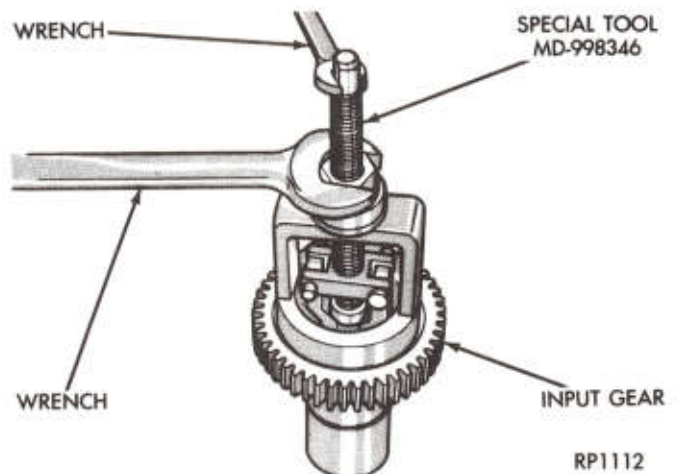
Fig. 4—Remove or Install Both Drive Sprocket Needle Bearings



RR21F32

Fig. 5—Front and Rear Bearing Position

Input Gear



RP1112

Fig. 1—Remove Mainshaft Pilot Bearing

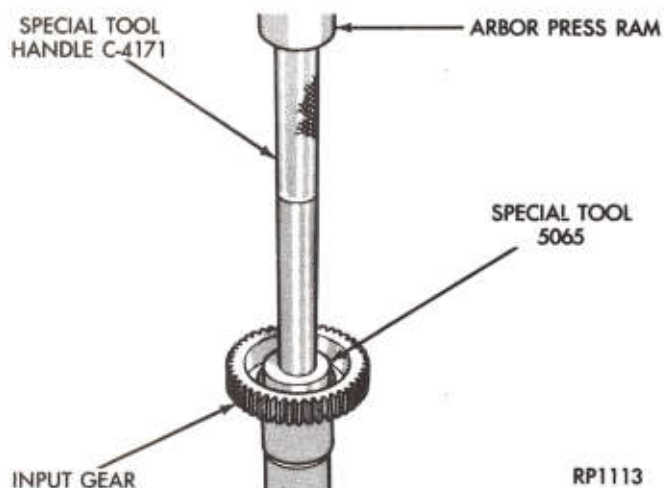


Fig. 2—Install Mainshaft Pilot Bearing Rear Retainer

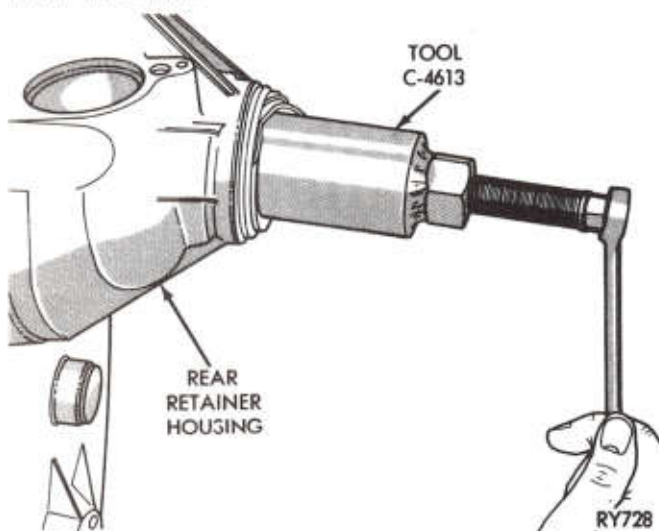


Fig. 1—Remove Rear Output Seal

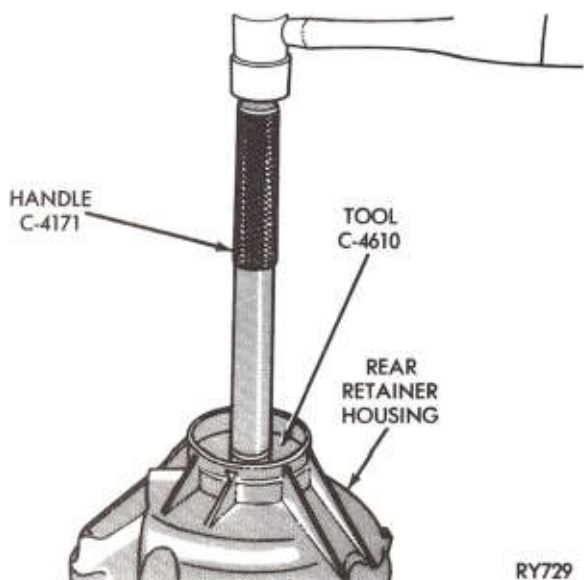


Fig. 2—Remove Rear Output Bearing

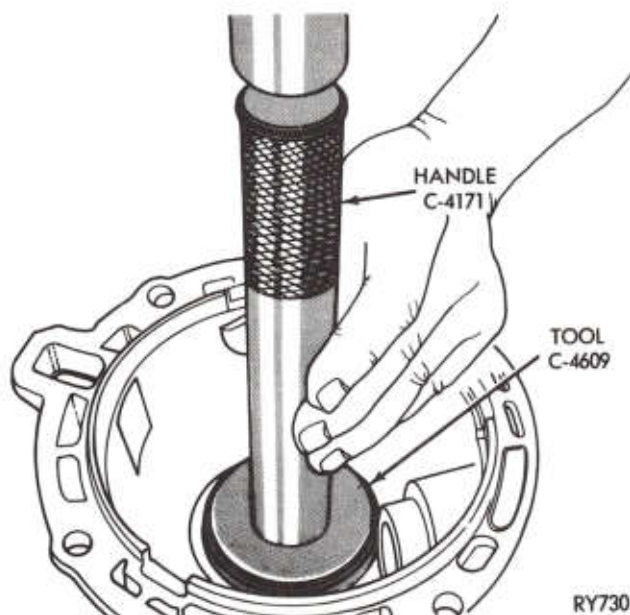


Fig. 3—Install Rear Output Bearing

Front Case

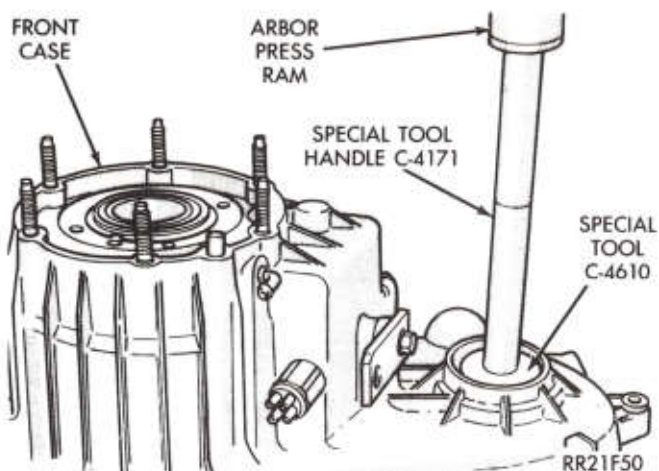


Fig. 1—Remove Front Output Shaft Front Bearing

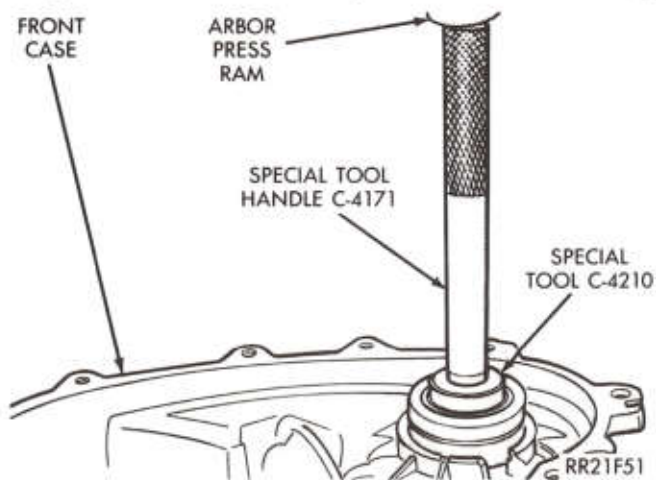
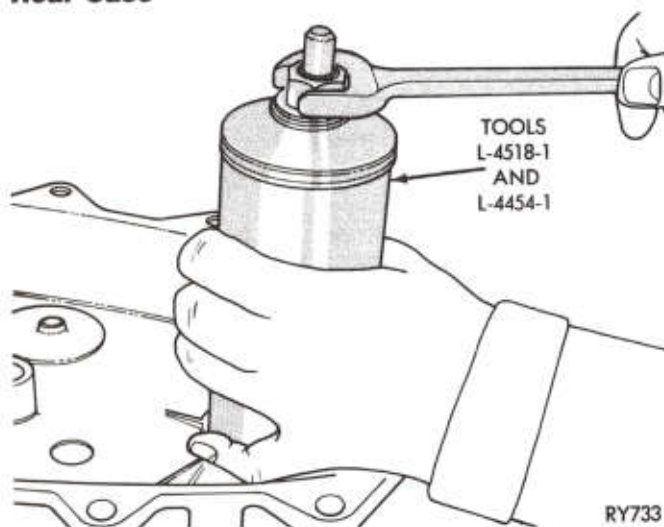
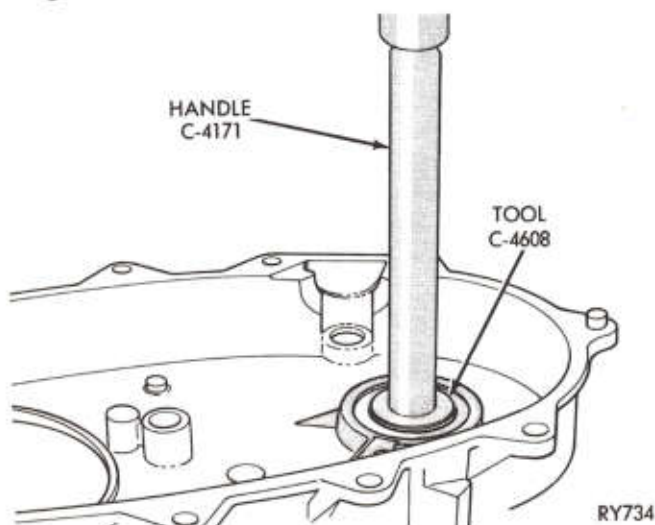


Fig. 2—Install Front Output Shaft Front Bearing

Rear Case**Fig. 1—Remove Front Output Shaft Rear Bearing****Fig. 2—Install Front Output Shaft Rear Bearing****CLEANING AND INSPECTION**

Wash all parts thoroughly in clean solvent. Be sure all old lubricant, RTV sealant, metallic particles, dirt or foreign material are removed from the surfaces of every part. Apply compressed air to each oil feed port and channel in each case half to remove any obstructions or cleaning solvent residue.

Inspect spline teeth on synchronizer sleeve, hub, and stop ring. If there is evidence of chipping or excessively worn teeth, install new parts at reassembly. Be sure clutch sleeve slides easily on the clutch hub.

Synchronizer springs should be in place with the tang inside the cavity of one strut and should not show signs of interference with the polished gear cone or inside diameters of the clutch hub.

Inspect stop ring for cracks and wear. If ring is cracked or shows signs of extreme wear on threaded bore, install new ring at reassembly. Test new rings for good fit on cone with minimum wobble. Check synchronizer struts for wear or breakage.

Inspect all gear teeth for signs of excessive wear or damage and check all gear splines for burrs, nicks, wear or damage. Remove minor nicks or scratches on oil stone. Replace any part exhibiting excessive wear or damage.

Inspect all snap rings and thrust washers for evidence of excessive wear, distortion or damage. Replace any of these parts if they exhibit these conditions.

Inspect the two case halves for cracks, porosity, damaged mating surfaces, stripped bolt threads, or distortion. Replace any part that exhibits these conditions.

Inspect the condition of all needle, roller, ball, and thrust bearings in the front and rear case halves and the input gear. Also check the condition of the bearing bores in both cases and in the input gear, rear output shaft, side gear, and rear retainer. Replace any part that exhibits signs of excessive wear or damage. If the case or input gear bearings require replacement, refer to the "Subassembly Overhaul" section.

SPECIFICATIONS

NP2500 OVERDRIVE 5-SPEED

Gear Ratio:	
First	3.79
Second	2.29
Third	1.48
Fourth	1.00
Overdrive	0.79
Reverse	3.90
Gear Type	Helical
Tolerances:	
Clutch Housing Face Squareness	.006 inch Max.
Clutch Housing Bore Runout	.008 inch Max.
Countershaft Gear End Play	.001 to .005 inch
Lubricant—Capacity:	
U.S. Pints	8
Metric Liters	3.8
Type	SAE 10W-30 Engine Oil

OVERDRIVE TRANSMISSION
(OVERDRIVE-4) ALL SYNCHRONIZED

Gear Ratio:	
First	3.09
Second	1.67
Third	1.00
Overdrive	0.71
Reverse	3.00
Gear Type	Helical
	(Except Reverse)
Tolerances:	
Clutch Housing Face Squareness	.006 inch Max.
Clutch Housing Bore Runout	.008 inch Max.
Countershaft Gear End Play	.015 to .029 inch
Countershaft to Case Bore Fit	.005 to .0065 inch Loose
Lubricant—Capacity:	
U.S. Pints	7
Metric Liters	3.3
Type	"DEXRON II" Type Automatic Transmission Fluid
Downshift Speed Limits:	
Overdrive to 3rd	50 to 25 mph (80 to 40 km/h)*
3rd to 2nd	25 to 15 mph (40 to 24 km/h)*
2nd to 1st	15 to 0 mph (24 to 0 km/h)*

*km/h = kilometers per hour.

LOADFLITE TRANSMISSIONS

Transmission Models:		A-904T/A-999		A-727	
TYPE		Automatic Three Speed with Torque Converter			
TORQUE CONVERTER DIAMETER (Standard)		10-3/4 inches		10-3/4 inches	
		U.S. Measure	Metric Measure	U.S. Measure	Metric Measure
OIL CAPACITY—TRANSMISSION AND TORQUE CONVERTER	Lock-up	17.1 Pts.	8.1 Liter	16.7 Pts.	7.9 Liter
	Nonlock-up	—	—	17.1 Pts.	8.1 Liter
Use (MOPAR ATF PLUS) Automatic Transmission Fluid Type 7176					
COOLING METHOD		Water-Heat Exchanger Pump (Gear Type)			
LUBRICATION					
GEAR RATIOS:		First	Second	Third	Reverse
	A-727	2.45 to 1	1.45 to 1	1 to 1	2.21 to 1
	A-904T/A/999	2.74 to 1	1.54 to 1	1 to 1	2.21 to 1
PUMP CLEARANCES:				.0035 to .0075 inch	
Outer Gear to Case Bore					
End Clearance—Gears		.0004 to .0025 inch		.001 to .003 inch	
GEAR TRAIN END PLAY		.005 to .048 inch		.006 to .048 inch	
INPUT SHAFT END PLAY		.022 to .091 inch		.034 to .084 inch	
SNAP RINGS:					
Rear Clutch Snap Ring (Selective)		.060 to .062 inch		.060 to .062 inch	
		.068 to .070 inch		.074 to .076 inch	
		.076 to .078 inch		.088 to .090 inch	
		.098 to .100 inch		.106 to .018 inch	
Output Shaft (Forward End)		.040 to .044 inch		.048 to .052 inch	
		.062 to .066 inch		.055 to .059 inch	
		.082 to .086 inch		.062 to .066 inch	
CLUTCH PLATE CLEARANCE:					
Front Clutch		4 Disc. .067 to .134 inch		4 Disc. .082 to .151 inch	
		5 Disc. .075 to .152 inch			
Rear Clutch		4 Disc. .032 to .055 inch		4 Disc. .025 to .045 inch	

	A-904T	A-999	A-727
CLUTCHES:			
Engine Liter	3.9L	5.2L	5.2L/5.9L
Number of Front Clutch Plates	4	5	4
Number of Front Clutch Discs	4	5	4
Number of Rear Clutch Plates	3	3	3
Number of Rear Clutch Discs	4	4	4
Number of Front Clutch Springs	1	1	11
BAND ADJUSTMENTS:			
Kickdown (Front) Turns*	2-1/2	2-1/2	2-1/2
Low-Reverse (Internal) Turns*	4	4	2

*Backed off from 72 inch-pounds (8 N·m).

21-118 TRANSMISSION—SPECIFICATIONS

THRUST WASHERS:	A-904T/A-999	A-727
Reaction Shaft Support Thrust Washer	#1 .061 to .063 inch	#1 Selective .061 to .063 inch (Natural) .084 to .086 inch (Red) .102 to .104 inch (Yellow)
Rear Clutch Retainer Thrust Washer	#2 .061 to .063 inch	#2 .061 to .063 inch (Natural)
Input Shaft Thrust Plate	.024 to .026 inch	
Output Shaft Thrust Washer	#3 Selective .052 to .054 inch (Tin) .068 to .070 inch (Red) .083 to .086 inch (Green)	#3 .062 to .064 inch
Output Shaft Thrust Plate	—	.030 to .032 inch
Front Annulus Thrust Washer	#4 .121 to .125 inch	
Front Carrier (To Annulus) Thrust Washer	#5 .048 to .050 inch	#4 .059 to .062 inch
Drive Shell (To Front Annulus) Thrust Washer	—	#5 .059 to .062 inch
Front Carrier (To Drive Shell) Thrust Washer	#6 .048 to .050 inch	
Sun Gear Drive Shell Thrust Plate	#7 .050 to .052 inch	#6 .034 to .036 inch
	#8 .050 to .052 inch	
Rear Carrier (To Drive Shell) Thrust Washer	#9 .048 to .050 inch	#7 .059 to .062 inch
Rear Carrier (To Annulus) Thrust Plate	—	#8 .034 to .036 inch
Rear Carrier (To Annulus) Thrust Washer	#10 .048 to .040 inch	

4-SPEED TRANSMISSION (NP435)

Type	4-Speed Dual P.T.O.
Model	435
No. of Forward Speeds	4
Ratios in Transmission (to 1)	
4th	1.00
3rd	1.66
2nd	3.34
1st	6.68
Reverse	8.26
Power Take-off Location	Both Sides
Type	6 Stud (S.A.E.)
Shift Lever	On Trans.
Lubricant Capacity	
U.S. Measure (Pts.)	7
Metric Measure (Liters)	3.3

NP205 TRANSFER CASE

Model No.—205	No. of Speeds—2	Ratio (High) 1:1	Ratio (Low) 1.96:1
Lubricant Capacity	(U.S. Pints)—4.5 (Liters)—2.1		
Lubricant Type	(See "Group-0, Lubrication")		

NP241 TRANSFER CASE

Transfer Case Type	4-position, dual-range, part-time 4-wheel-drive unit with integral low range	Drive positions and shift controls	2H, 4H, 4L, Neutral—Ranges selected via floor-mounted shift lever
Torque Transmittal Mode ..	Dual sprockets with interconnecting drive chain	Case Configuration	Two-piece aluminum casting with removable rear retainer
Low Range Reduction Ratio and Mode	2.6:1 through annulus gear and planetary carrier assembly	Lubricant Capacity and Type	4.6 pints (2.1 liters) MOPAR ATF PLUS (Type 7176) or DEXRON II Oil

TIGHTENING REFERENCE

NP2500 Overdrive 5-Speed					
	Ft. Lbs.	N-m		Ft. Lbs.	N-m
Access Cover Bolts	21	28	Shift Assembly to Extension Bolts	21	28
Back-Up Lamp Switch	15	20	Speedometer Drive Clamp Screw	8	11
Center Support to Case	40	54	Transmission to Clutch Housing Bolts	50	68
Extension Housing to Case Bolts	40	54	Transmission Drain Plug	30	41
Gearshift Lever	30	41	Transmission Fill Plug	30	41
Input Shaft Bearing Retaining Bolts	21	28			
Manual "Overdrive-4" 4 Speed					
	Ft. Lbs.	N-m		Ft. Lbs.	N-m
Back-Up Light Switch	15	20	Shift Lever Nuts	18	24
Drive Pinion Bearing Retaining Bolts .	30	41	Transmission to Clutch Housing Bolts	50	68
Extension Housing to Case Bolts	50	68	Transmission Drain Plug	25	34
Gearshift to Mounting Plate	24	33			
Gearshift Mounting Plate to Extension	12	16			
Manual NP435 4 Speed					
	Ft. Lbs.	N-m		Ft. Lbs.	N-m
Cover Screw	30	41	Mainshaft Rear Retainer Screw	20	27
Drive Gear Retainer Screw	20	27	Rear Countershaft Retainer Screw ...	20	27
Front Countershaft Retainer Screw ..	20	27	PTO Cover Screw	10	14
Front Countershaft Bearing Washer Screw	17	23	Filler and Drain Plug	35	47
Flange Nut	125	169	Reverse Idle Shaft Lock Screw	30	41
			Brake Link Shoulder Screw	40	41
Automatic (LoadFlite) A-904T/A-999/A-727					
	Ft. Lbs.	N-m		Ft. Lbs.	N-m
Cooler Line Fitting	155*	18	Neutral Starter Switch	25	34
Cooler Line Nut	85*	10	Oil Pan Bolt	150*	17
Converter Drive Plate to Crankshaft Bolt	55	75	Oil Pump Housing to Transmission Case Bolt	175*	20
Converter Drive Plate to Torque Converter Bolt	270*	31	Output Shaft Support Bolt	150*	17
Extension Housing to Transmission Case Bolt	32	43	Overrunning Clutch Cam Set Screw ..	40*	5
Extension Housing to Insulator Mounting Bolt	50	68	Pressure Test Take-Off Plug	120*	14
Governor Body to Support Bolt	95	11	Reaction Shaft Support to Oil Pump Bolt	175*	20
Kickdown Band Adjusting Screw Locknut	30	41	Reverse Band Adjusting Screw Locknut	25	34
Kickdown Lever Shaft Plug	150*	17	Speedometer Drive Clamp Screw	100*	11
Lockup Solenoid Wiring Connector	150*	17	Transmission to Engine Bolt	30	41
			Valve Body Screw	35*	4
			Valve Body to Transmission Case Bolt	105*	12

*Inch Pounds

*Inch Pounds

21-120 TRANSMISSION—TIGHTENING REFERENCE

NP205 TRANSFER CASE					
	Ft. Lbs.	N-m		Ft. Lbs.	N-m
Bearing Preload	5-30*	7-41	Poppet Screw	20	27
Drain & Fill Plugs	40	54	PTO to Case	35	47
Front Adapter Screws	30	41	PTO Cover Screws	35	47
Front Output Flange Nut	110	149	Rear Output Yoke Nut	138	187
Front Output Rear Brg. Retainer	30	41	Rear Retainer Assy.	30	41
Front Output Seal Retainer	30	41	Rear Seal Retainer	30	41
Idler Shaft Cover	20	27	Transfer Case to Extension	35	47
Idler Shaft Nut	138	187			

NP241 TRANSFER CASE					
	Ft. Lbs.	N-m		Ft. Lbs.	N-m
Detent Retainer Bolt	23	31	Operating Lever Locknut	90*	10
Drain and Fill Plugs	40	54	Rear Case-to-Front Case Bolts (All) ..	23	31
Front and Rear Yoke Nuts	120	163	Rear Retainer Bolts	23	31
Indicator Switch	18	24	Transfer Case to Extension	40	54

*Inch Pounds

WHEELS-TIRES

INDEX

	Page		Page
General Information	1	Safety Rim Wheels	5
Service Procedures	2	Wear Indicators	4
Cleaning	2	Wear Patterns	4
Inflation Pressures	2	Balance	7
Noise and Vibration	4	Installation	5
Pressure Gauges	2	Mounting	6
Repairing Leaks	3	Runout	6
Rotation	3	Wheel Stud Nut Tightening	5

GENERAL INFORMATION

Wheels, wheel parts, rims, and tires are designed to give maximum durability and performance when properly maintained. Wheels, as specified in this manual, require special tools for proper stud tightening. Therefore, operators are advised to change wheel and tire assemblies only when proper facilities or special tools are available.

Wheel bearing lubrication instructions are detailed in Group 0. Wheel bearing removal, installation, and wheel alignment instructions are detailed in Groups 2 and 3.

Proper wheel and tire balances and front end alignment must be maintained for extended tire life. Inflation pressures, as associated with tire sizes, are specified in the tire charts at the rear of this group.

To maintain quality of rims and wheels, a continuous inspection program is recommended. These procedures should be carried out during routine tire inspection and at time of tire changes.

Tires, as described in Figure 1, are designed for the vehicle and provide the best overall performance for normal operation; furthermore, the ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability traction, skid resistance, and tread life.

Bias-ply tire body cords extend from bead to bead at an angle across the center line of the tread. Alternate plies cross at opposite angles.

Radial-ply tires also have belts that circle the tire under the tread from tread shoulder to tread shoulder. The body cords cross the center line of the tread at approximately right angles, from bead to bead. The body cords 'radiate' from the center point of the tire ... hence the term 'radial-ply'.

Radial-ply tires provide improved tread life, road hazard resistance, and smoother high-speed ride. The radial-ply tires, available as optional equipment from Chrysler Motors, are identified by the "R" in their size description: 8.75R-16.5 (as compared with 8.75-16.5-E for regular construction), are selected to complement the ride and handling characteristics of your vehicle. However, there are significant differences in

the ride and handling characteristics of vehicles equipped with radial-ply tires. You may initially find these unfamiliar characteristics require some adjustment in your driving technique.

Radial-ply tires have the same load carrying capacity as other types of tires of the same size, but may use different inflation pressures. Consult the "Tire Inflation Pamphlet" (found in the glove compartment of the vehicle) for correct inflation pressure.

Tire wear and vehicle stability are affected greatly by tire size, tire pressures, wheel rim size, distribution of load within the vehicle, wheel alignment, road surface conditions, and driver operating habits.

Tires used at low speeds, in cool climates, and with light loads, will have longer life than tires used for high-speed driving in hot climates with heavy loads.

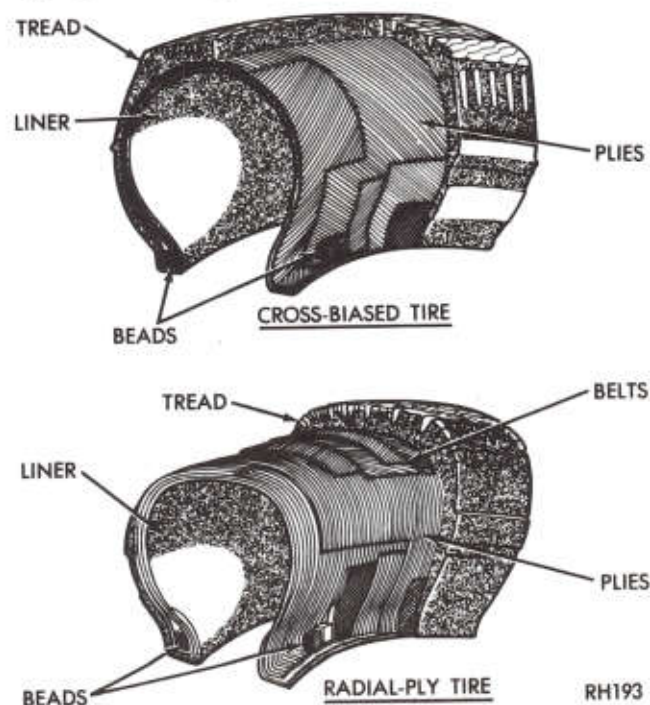


Fig. 1—Tire Construction

Abrasive road surfaces will accelerate tire wear.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain, in most cases, much greater mileage than severe or careless drivers. Rapid acceleration and deceleration, severe application of brakes, high-speed driving, taking turns at excessive speeds, striking curbs and other obstacles

are just a few of the driving habits which will shorten the life of any tire.

To obtain maximum vehicle stability and tire life, the vehicle should be equipped with the recommended suspension application including the proper tire size. The recommended full-rated load should not be exceeded.

SERVICE PROCEDURES

CLEANING

Some white sidewall tires have colored protective coating that should be removed from the tires before delivery of the vehicle. This protective coating is not as flexible as rubber and will crack. This may introduce sidewall checking if not removed. In no case should the tires be driven more than 50 miles (80 kilometers) before this coating is removed.

To remove this coating, wet the tire surface thoroughly with warm water and allow it to soak for one minute. Using a soft-bristle brush or sponge, wash the protective coating from the tire. This coating may also be removed by steam cleaning. **Do not use gasoline or other solvents. Do not use a wire brush.**

After the vehicle is in service, ordinary road dirt that collects on white sidewall tires may be cleaned with soap or a nonabrasive cleaner and (if necessary) a soft bristle brush. Under no circumstances should gasoline, kerosene, or any cleaning fluid containing a solvent derived from oil be used to clean white sidewall tires. Mineral oil in any form is detrimental to rubber, and a cleaner with an oil base solvent will discolor or injure any tire.

INFLATION PRESSURES

Proper tire inflation pressure is essential to the safe and satisfactory operation of your vehicle. Three primary areas are affected by improper tire pressure:

1. Underinflation causes increased tire flexing and can result in tire failure. Overinflation results in a tire losing its ability to cushion shock. Objects on the road and chuck holes could cause tire injury that may result in tire failure.

2. Improper inflation pressures can cause uneven wear patterns to develop across the tire tread. These abnormal wear patterns will reduce tread life resulting in a need for earlier tire replacement.

3. Proper tire inflation pressures contribute to the good ride qualities built into your vehicle. Overinflation produces an uncomfortable and jarring ride. Underinflation or overinflation affect vehicle stability characteristics and can produce a sluggish responding feeling or overresponsiveness. Unequal inflation pres-

ures, except where designed, can produce erratic and unpredictable vehicle response to steering maneuvers.

Underinflation results in much faster wear of the shoulders than the center of tread.

Overinflation causes faster wear at the center of the tread and the possibility of cuts, punctures, and bruises.

When alternate underinflation and overinflation, exceeding recommended full-rated load or high temperature, or high-speed driving is experienced, cracked treads will result.

The proper pressure for your vehicle is listed in the "Tire Inflation Pamphlet" (found in the glove compartment of the vehicle).

These pressures have been carefully selected to provide for safe vehicle operation, proper vehicle stability, and a comfortable ride. These pressures should be checked and maintained at least once per month and should be checked "cold". Tire pressures should be checked more often when weather temperatures vary widely, because tire pressure decreases when outdoor temperatures drop.

The recommended inflation pressures should be followed when any of the allowable tire sizes authorized for the vehicle are installed.

Cold inflation pressure is obtained after the vehicle has not been operated for at least 3 hours or driven less than 1 mile after being inoperative for 3 hours. Tire inflation pressures may increase from 2 to 6 psi (14 to 41 kPa) during operation. Do not reduce this normal pressure build-up.

PRESSURE GAUGES

Because of the wide variation of many pressure gauges on service station air towers, it is suggested that an inexpensive pencil-type air-pressure gauge be purchased and kept in the glove box for use whenever tire pressures are checked. See the vehicle operator's manual for additional information.

Tire valve caps (or valve extensions) should always be reinstalled on the valve and tightened finger tight. They assist in retaining air and also keep foreign material out of the valve.

ROTATION

Under normal operating conditions, it is recommended that all tires be rotated every second oil change and should be in correct balance to obtain the most uniform tread wear. Tire inspection at every oil change is recommended and if irregular tread wear is evident, rotation of tires is suggested at that time. Be sure to always adjust tire pressures properly after rotation. Proper tire rotation at the recommended intervals reduces the possibility of tire noise and equalizes tire wear. Figures 2 or 3 show the recommended sequence for the rotation of tires. Under conditions of severe service (trailer towing) tires should be rotated more frequently.

Uneven tire wear is frequently the cause of tire induced noises which are attributed to rear axle gears, bearings, etc. Unnecessary work is often performed on other chassis components in an effort to correct tire noises.

Mixing of radial-ply tires with other types of tires is not recommended. Mixed combinations of tires, when installed on the same vehicle, will deteriorate vehicle handling.

Radial-ply tires must always be used in sets of five and under no circumstances should they be used on the front only.

As longer wearing tires can be more susceptible to irregular tread wear, it is very important to follow the tire rotation interval shown to achieve the tread life potential in these tires.

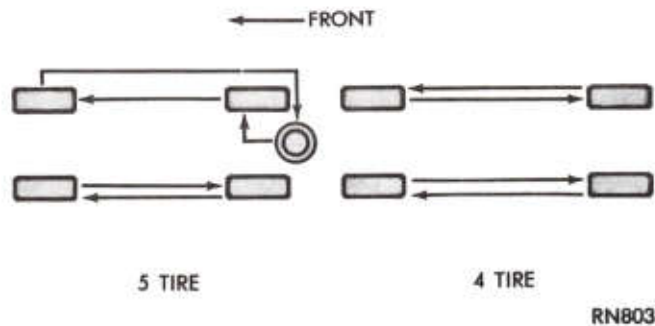


Fig. 2—Radial-Ply Tire Rotation

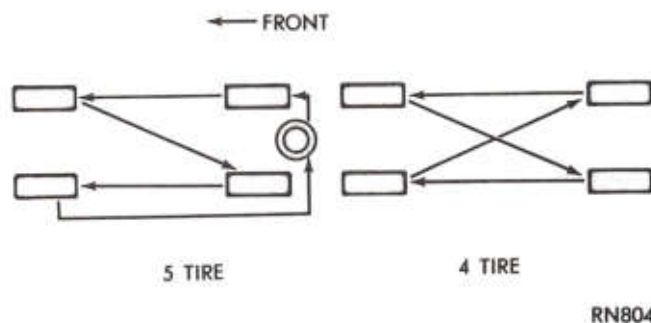


Fig. 3—Bias-Belted Tire Rotation

REPAIRING LEAKS

Leaks between the tire and wheel require the removal of the tire. Leaks in the tire can often be repaired without removing the tire. Always follow the equipment manufacturer's recommendations.

Tools used for dismounting and mounting tires must be smooth and free from sharp edges or burrs which could damage the tire or wheel rim.

The tire must be completely deflated before the tire

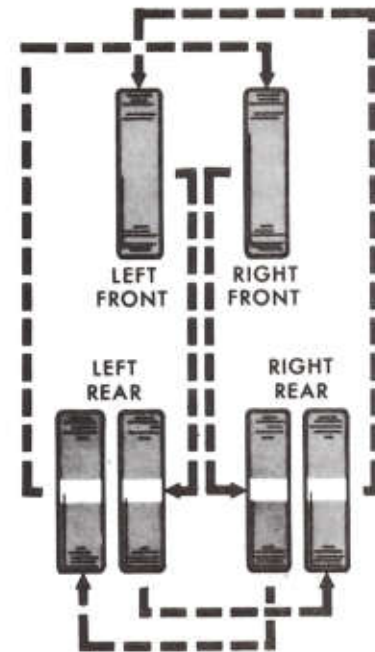


Fig. 4—Tire Rotation for Dual Bias-Ply Tires

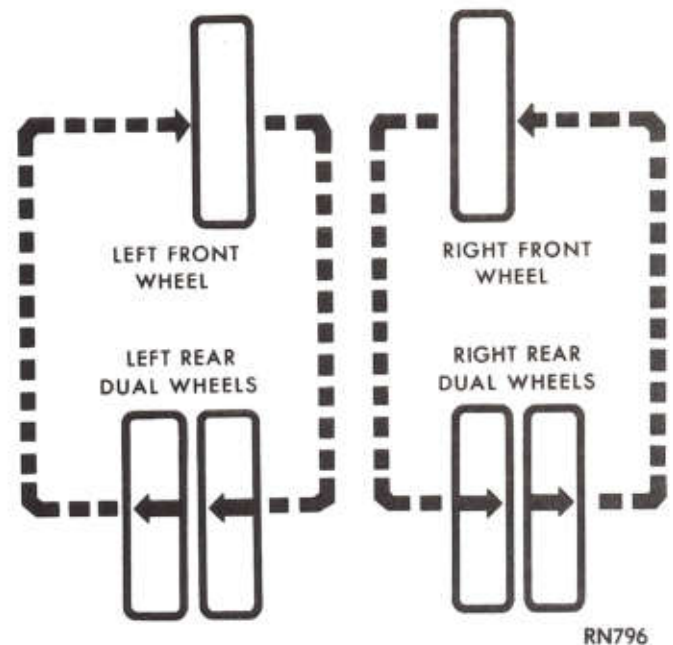


Fig. 5—Tire Rotation for Dual Radial-Ply Tires

beads are removed from the seats. Before mounting the tire on the wheel, make sure all rust scale is removed from the rim and repaint if necessary. Lubrication, in the form of a mild soap solution or a commercial mounting lubricant **MUST** be applied to both tire bead surfaces when mounting or dismounting a tire.

Commercial tourniquet type bead expanders can be used to seat the beads of bias tires, but the bias-belted and radial-ply tires require one of several newer types developed for less flexible tires.

TREAD WEAR INDICATORS

Your potential driving, cornering, and braking traction decreases as your tires wear. Furthermore, as the tread depth is decreased the tires have less resistance to road hazards and are more likely to hydroplane on wet pavement. Tread wear indicators have been provided to assist you in determining when your tires are worn so as to require replacement. These indicators are molded into the bottom of the tread grooves and will appear as approximately 1/2 inch (13 mm) wide bands when this tread depth has been reduced to 1/16 inch (1.6 mm) (Fig. 6). Tire replacement due to tread wear is necessary when these indicators appear in two or more adjacent grooves or a localized worn spot eliminates all the tread.

NOISE AND VIBRATION

To determine if the tires are causing the noise or vibration, drive the vehicle over a smooth portion of highway at different speeds and note the effect of acceleration and deceleration on noise level. Axle and exhaust noise change in intensity as speed varies, while tire noise will usually remain constant. If after road testing the vehicle it was determined that tires

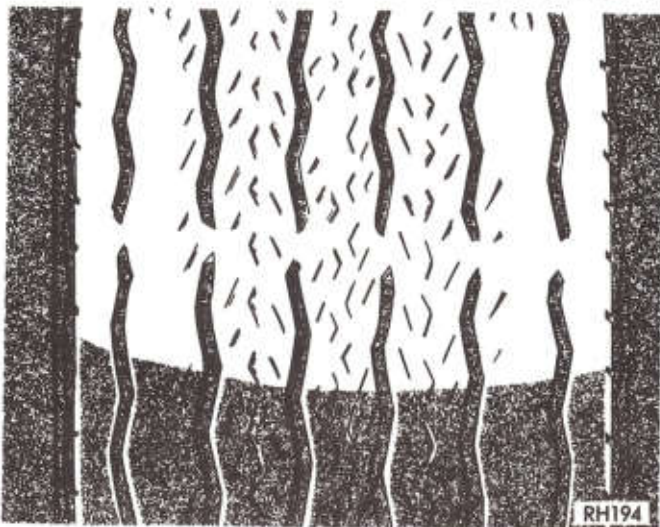


Fig. 6—Tread Wear Indicator

may be causing the noise, **balance all tires and inflate to 50 psi (344 kPa)**. Drive the vehicle over the same route at the same speeds as before to determine that the disturbance has changed. **If the disturbance is changed or eliminated by overinflating the tires, continue the road test by lowering the pressure one tire at a time to normal. When the disturbance returns, the last tire deflated will usually be the offender.** Tire thump (sometimes referred to as "tramp") usually occurs in the speed range of 20-40 mph (32-64 km/h) and can usually be located this way. If you have a "thumper", replace the tire.

Tire roughness can be caused by a single tire with two or more "thump" spots in it, or by two or more thumping tires at speeds of 40-70 mph (64-112 km/h). To isolate the cause of this condition, you may have to substitute the spare for each of the four tires, with all tires inflated to normal pressure. Tire roughness is recognized as a low-frequency rumble or vibration and is very similar to drive line vibration. Positive separation of the two disturbances can only be accomplished by using a known set of good tires or by towing the vehicle with the propeller shaft removed. To correct tire roughness, replace the offending tires.

WEAR PATTERNS (Fig. 7)

An inspection of the tires, together with information as to locality of vehicle operation will usually indicate abnormal wear due to operating conditions or mechanical faults, which should be corrected. Various types of abnormal tire wear with their causes and corrective actions are shown in Figure 7.

Excessive wheel camber, either positive or negative, causes the tire to run at an angle to the road. One side of the tread wears more than the other. For best corrective results, have the front wheel camber adjusted to specifications and rotate tires.

Excessive toe-in or toe-out causes wear on the edges of the front tires. An excessive amount of either toe-in or toe-out actually drags the tire instead of letting the tire roll true. This wear condition will usually produce a tapered or feathered edge on the outside ribs. Have the toe-in or toe-out adjusted to specifications to correct and rotate tires.

Cupping, scalloping, and spotting of tires is associated with wear on a vehicle driven mostly at highway speeds without the recommended tire rotation and with unbalance conditions. Regardless of the cause of cupped wear on either front tire, no alignment or balance job can prevent future excessive wear of the spots if tire is not rotated to a different location. Once a front tire acquires flat or cupped spots additional wear will continue at a rapid rate if left uncorrected. To correct this condition, tire rotation and wheel balance are necessary. A cupped tire may partially true itself up on a rear wheel.

CONDITION	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
EFFECT							
CAUSE	UNDER-INFLATION OR LACK OF ROTATION	OVER-INFLATION OR LACK OF ROTATION	UNDER-INFLATION OR EXCESSIVE SPEED*	EXCESSIVE CAMBER	INCORRECT TOE	UNBALANCED WHEEL OR TIRE DEFECT *	LACK OF ROTATION OF TIRES OR WORN OR OUT-OF-ALIGNMENT SUSPENSION.
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES			ADJUST CAMBER TO SPECIFICATIONS	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION SEE GROUP 2

*HAVE TIRE INSPECTED FOR FURTHER USE.

RN797

Fig. 7—Wear Patterns

WHEEL STUD NUT TIGHTENING Safety Rim Wheels

Some models use steel, drop-center wheels. The safety-rim wheel (Fig. 8) has raised sections between the rim flanges and the rim well. Initial inflation of the tire forces the bead over these raised sections. Tire-to-wheel separation under extreme hard cornering is prevented by air pressure and these safety humps. Furthermore, in case of a tire failure, the raised sections help hold the tire in position on the wheel until the vehicle can be brought to a safe stop.

When installing wheels on the vehicle, progressively tighten wheel nuts in sequence shown in Figure 9 to proper torque specifications. All wheel stud nuts, bolts, and nuts have right hand threads.

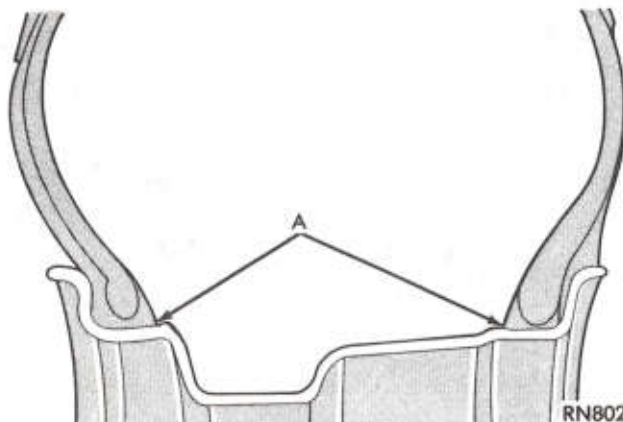


Fig. 8—Safety Rim

Eight-Stud Dual Rear Wheels With Flanged Type Wheel Nuts

Models D-350 and W-350

These wheels have four equally-spaced stud holes which are coined outward and four which are coined inward. The outer wheel must be installed so the coined stud holes match the coined stud holes of the inner wheel (Fig. 10).

A locating pin in the hub will assist in properly orienting the inner and outer wheels. The tires of both dual wheels must be completely off the ground when tightening to insure wheel centering and maximum wheel clamping. These dual rear wheels should be tightened as follows:

(1) Tighten the wheel nuts in the numbered sequence to a snug fit (Fig. 11).

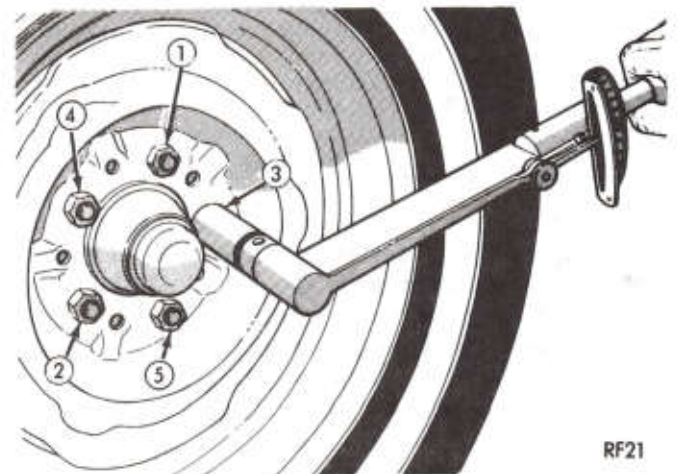


Fig. 9—Safety Rim Wheel Tightening Sequence

LOCATING PIN HOLE IN BOTH INNER & OUTER WHEEL MUST ENGAGE LOCATING PIN IN HUB WHEN WHEELS ARE INSTALLED.

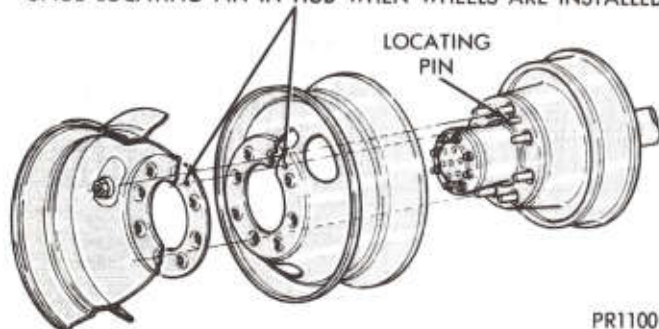


Fig. 10—Eight-Stud Dual Rear Wheels

(2) Retighten the wheel nuts in the same sequence to a torque of 325 ft. lb. (441 N·m). Go through the sequence a second time to verify that specific torque has been achieved. Retighten to specifications at 100 miles (160 kilometers) and after 500 miles (800 kilometers).

RUNOUT

A tire and wheel assembly may have radial or lateral runout, or a combination of both. Although initial readings are normally made on the tire, any runout found could be due to irregularity of either the tire or wheel, or both. Therefore, when excessive radial or lateral runout is found, tire should be removed from wheel and wheel checked alone. This procedure should enable determination of which part is at fault. Figure 12 specifies runout checking points.

The radial runout at each point indicated by "A" (Figure 12) and lateral runout at each point indicated by "B" should not exceed the following specifications.

Wheel Size	Point "A" Radial Runout	Point "B" Lateral Runout
15 x 5.5	.035 in. (.889mm)	.045 in. (1.04mm)
15 x 6.5	.030 in. (.762mm)	.045 in. (1.04mm)
15 x 7.0	.030 in. (.762mm)	.045 in. (1.04mm)
16 x 6.0	.045 in. (1.04mm)	.045 in. (1.04mm)
16.5 x 6.0	.045 in. (1.04mm)	.045 in. (1.04mm)
16.5 x 6.75	.045 in. (1.04mm)	.045 in. (1.04mm)

Under no circumstances should point indicated by "C" in Figure 12 be used for checking runout as this metal has been sheared in the manufacturing process and as a result is not an even surface.

When checking wheel for runout, attach wheel to a hub that is free to rotate, but tight enough to prevent wobble. The dial indicator should be of known accuracy and attached to a firm surface to assure steadiness while taking readings.

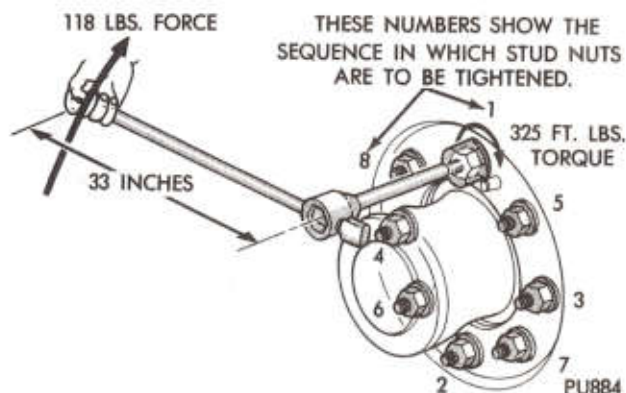


Fig. 11—Eight-Stud Dual Rear Wheel Tightening Sequence

MOUNTING

Some D350 and W350 models are equipped with dual-disc wheel on rear axles. These chassis utilize 8-stud disc wheel and flanged type wheel nuts.

All wheels have four equally-spaced stud holes which are coined inward and four equally-spaced stud holes which are coined outward. The outer wheel must be installed so that coined stud holes match coined stud holes of inner wheel. Line up wheels with locating pin.

A locating pin in the hub will assist in properly orienting inner and outer wheels. The tires of both dual wheels must be completely off the ground when tightening to insure wheel centering and maximum wheel clamping.

Tighten dual rear wheel nuts in the numbered sequence. Retighten wheel nuts in the same sequence again, but this time torque to 325 ft. lbs. (441 N·m). Go through sequence again to verify specified torque has been achieved.

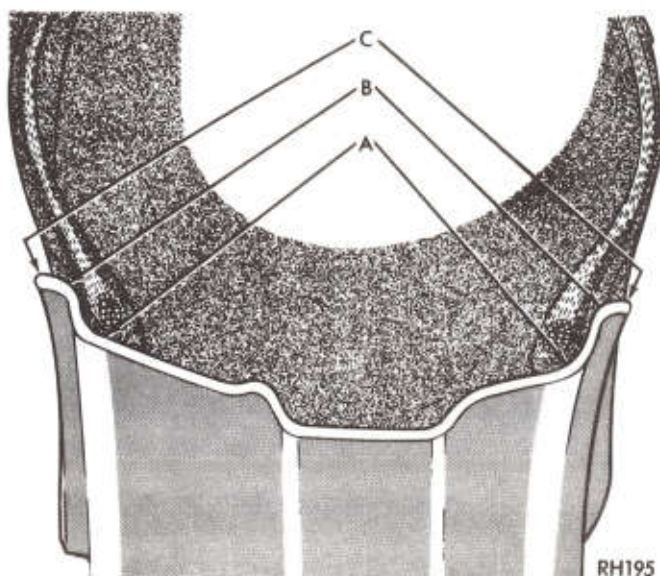


Fig. 12—Runout Areas

Wheel stud nuts should be torqued as specified at every lubrication interval (2000 miles) (3218 km) thereafter. Also, when changing a wheel, that wheel should be retightened at 100 and 500 miles (160 and 800 km) thereafter.

On these models, a 1-1/8 inch flanged type wheel stud nut is used when equipped with dual rear wheels. Only right hand threaded nuts and studs are used. This flange type nut requires inspection and torque checking every 2,000 miles (3 218 km) and can be used on previous model vehicles. A proper wheel wrench will be required; the wrench is necessary to properly tighten the nuts to required torque of 325 ft. lbs. (441 N·m).

TIRE AND WHEEL ASSEMBLY BALANCE

The need for tire and wheel assembly balancing is indicated by heavy vibration of the steering wheel when driving at speeds above 40 mph (64 km/h). The two types of balance conditions are as follows:

• STATIC BALANCE

A wheel and tire assembly is in static balance when the weight of the tire and wheel is evenly distributed about the hub axis (or center) of the assembly as viewed from the side. In other words, there is no "heavy spot" that would cause the wheel and tire to stop in the same place if it were spun freely like a roulette wheel. An assembly that is not in balance statically will hop or bounce in the medium to high-

speed ranges. The greater the unbalance, the lower the speed at which the hop will occur.

• DYNAMIC BALANCE

A wheel and tire are in dynamic balance when the weight of the inside and the outside half are distributed equally around the circumference of the assembly. In other words, the inside half of the tire is in balance with the outside half of the tire. Dynamic unbalance is corrected by adding sufficient weight to the light sections of the tire to counteract or balance the heavier sections.

When adding weights to balance an assembly dynamically, it is important to avoid creating a condition of static unbalance. This is accomplished by dividing the total weight required in half and placing the two halves on opposite sides of the wheel and 180 degrees apart.

PREFERRED METHOD

Off-the-vehicle balancing is the preferred method. Balancing tires on the vehicle essentially balances the tire, wheel, and brake drum/rotor. This balance condition is lost when tires are rotated to equalize tire tread wear or when tires are removed for any reason and not reinstalled in the same position and indexed on the studs exactly as before removal.

For additional information refer to the instructions supplied by manufacturer of balancing equipment being used.

SPECIFICATIONS

SUFFIX LETTERS USED IN TIRE SIZE DESIGNATIONS

Suffix letters are included, when necessary, as part of Tire Size Designations to differentiate between tires designed for service conditions which may require different loads and inflations and/or tires designed for and must be used on different types of rims. Definitions are as follows:

LT—Identifies a tire designed for service on Trucks, Busses, Trailers, and Multipurpose Passenger Vehicles used in normal highway service, used with 5° tapered rims of nominal .032 inch (.812mm) diameters. This suffix is intended to differentiate among tires for Passenger Car, Truck-Bus and other vehicles or other services which use a similar designation. Example: 7.00-15, 7.00-15LT.

The term "Load Range" with a letter (A,B,C, etc.) in tire identification is used to identify a given size tire with its load and inflation limits when used in a specific type of service.

Each load range (ply rating) tire may be inflated up to the maximum pressure shown for it in the tables. Metric

tires may be inflated up to 35 psi (241 kPa), except for Load Range XL tires which may be inflated up to 41 psi (283 kPa).

For type LT (light truck) tires, maximum pressure is 30 psi (206 kPa) for Load Range B (4-ply rating), 45 psi (310 kPa) for Load Range C (6-ply rating), 60 psi (413 kPa) for Load Range D (8-ply rating), and 75 psi (517 kPa) for Load Range E (10-ply rating). **Add 5 psi for radial-ply tires.**

Load Range	Replaces Ply Rating
A	2
B	4
C	6
D	8
E	10
F	12
XL (Extra Load)	6

TIRE CHART

D150

WHEELBASE: 115 (2921mm), 131 (3327mm), 133 (3378mm), 149 (3784mm)

Tire and Wheel	GVWR pounds (kg)				Trailer Towing	
	4800 (2177)	5350 (2432) 5500 (2494)	5850 (2654)	6010 (2732)	Light Duty	Heavy Duty
P195/75R15(5.5)	STD	—	—	—	Same minimum tire usage as without trailer towing.	
P215/75R15(5.5)	EXT	STD	—	—		
P235/70R15(6.5)	EXT	EXT	—	—		
P235/75R15(6.5)	EXT	EXT	STD	STD		
P255/70R15(6.5)	EXT	EXT	EXT	EXT		
LR60-15B(7.0)	EXT	EXT	EXT	N.A.		
7.00R-15LT-D(6.5)	EXT	EXT	EXT	EXT		
P235/75R15-XL(6.5)	—	—	—	Note (1)		

(1) STD w/California 6 Cyl. 115" W.B. Only.

W150 (6050 GVWR)

WHEELBASE

115 (2921mm), 131 (3327mm), 133 (3378mm), 149 (3784mm)

Tire and Wheel	GVWR pounds (kg)	Trailer Towing	
	6050 (2744)	Light Duty	Heavy Duty
P235/75R15(6.5)	STD	Same minimum tire usage as without trailer towing.	
P255/70R15(6.5)	EXT		
LR60-15B(7.0)	EXT		
10R-15LT-B(7.0)	EXT		
7.00R-15LT-D(6.5)	EXT		
P235/75R15-XL(6.5)	STD Note (1)		

(1) STD w/Snow Plow which is not available with Trailer Towing.

XL—Extra Load

D250 WITH 131 INCH (3327mm) WHEELBASE

Tire and Wheel	GVWR pounds (kg)		
	6500 (2948)	7500 (3402)	8550 (3878)
8.00-16.5-D (6.0)	STD	—	—
8.00-16.5-E (6.0)	EXT	—	—
8.75-16.5-E (6.75)	EXT	STD	—
9.50-16.5-E (6.75)	N.A.	N.A.	STD
7.50-16LT-E (6.0)	EXT	EXT	N.A.

D250 WITH 149 INCH (3784mm) WHEELBASE CREW CAB

8.75-16.5-E (6.75)	—	STD	—
9.75-16.5-E (6.75)	—	N.A.	STD
7.50-16LT-E (6.0)	—	EXT	N.A.

D250 WITH 149 INCH (3784mm) WHEELBASE CREW CAB

9.50-16.5-E (6.75)	—	—	STD
7.50-16LT-E (6.0)	—	—	N.A.

D250 WITH 165 INCH (4191mm) WHEELBASE CREW CAB

9.50-16.5-E (6.75)	—	—	STD
7.50-16LT-E (6.0)	—	—	N.A.

NOTE: Light-Duty Trailer Towing Pkg. Maximum Weight 2000 lbs. for all GVWR's. Heavy-Duty Trailer Towing Pkg. Maximum Weight 7000 lbs. (3175 kg) for 7500 and 8550 only.

**W250 WITH 131 INCH (3327mm), 149 INCH (3784mm) CLUB CAB, AND
149 INCH (3784mm) CREW CAB**

Tire and Wheel	GVWR pounds (kg)			SNOW PLOW		
	6900 (3129)	7500 (3402)	8550 (3878)	7500 (3402)	8550 (3810)	8550 H.D. Plow
8.00-16.5-D (6.0)	STD	—	—	—	—	—
8.00-16.5-E (6.0)	EXT	STD	—	STD	—	—
8.75-16.5-E (6.75)	EXT	EXT	—	EXT	—	—
7.50-16LT-E (6.0)	EXT	EXT	N.A.	EXT	N.A.	N.A.
9.50-16.5-E (6.75)	N.A.	N.A.	STD	—	STD	STD

Light-Duty Trailer Towing Pkg. Maximum Weight 2000 lbs. (907Kg) for all W250 GVWR's. Heavy-Duty Trailer Tow Pkg. Maximum 7000 lbs. (3175kg) for 8550 GVWR ONLY. Trailer Tow Pkg. not available for Snow Plow.

W350 WITH 135 INCH (3429mm) WHEELBASE

Dual Tire and Wheel	GVWR pounds (kg)
	10,000 (4536)
8.00-16.5-D (6.0)	STD
8.00-16.5-E (6.0)	EXT
7.50-16LT-E (6.0)	EXT

Light - or Heavy-Duty Trailer Tow Pkg. NOT APPLICABLE to W350 vehicles.

D350 WITH 131 INCH (3327mm) WHEELBASE

Dual Tire and Wheel	GVWR pounds (kg)	
	(Single) 9,000 (4082)	(Duals) 10,000 (4536)
8.00-16.5-D (6.0)	—	STD
9.50-16.5-E (6.75)	STD	—
7.50-16LT-E (6.0)	—	EXT

For Trailer Tow vehicles, the minimum tire shown is standard for GVWR shown. Maximum trailer weight is 2000 lbs. (907 kg).

D350 WITH 135 INCH (3429mm) WHEELBASE (DUALS)

Dual Tire and Wheel	GVWR pounds (kg)	
	10,000 (4536)	10,500 (4762)
8.00-16.5-E (6.0)	STD	STD
7.50-16LT-E (6.0)	EXT	EXT

D350 WITH 149 INCH (3784mm) WHEELBASE

Dual Tire and Wheel	GVWR pounds (kg)	
	10,000 (4536)	
	Club Cab	Cab/Chassis
8.00-16.5-D (6.0)	STD	—
8.00-16.5-E (6.0)	EXT	STD
7.50-16LT-E (6.0)	EXT	EXT

For Trailer Tow vehicles the minimum tire size shown is standard for 10,000 lb. (4536 kg) GVWR. The 2000 lb. (907 kg) and 10,000 lb. (4536 kg) Trailer Tow is available for both 149 inch wheelbase vehicles.

D350 WITH 159 INCH (4038mm) WHEELBASE

Dual Tire and Wheel	GVWR pounds (kg)	
	10,000 (4536)	10,500 (4762)
8.00-16.5-E (6.0)	STD	STD
7.50-16LT-E (6.0)	EXT	EXT

D350 WITH 165 INCH (4191mm) WHEELBASE

GVWR pounds (kg)

Dual Tire and Wheel**10,000 (4536)**

8.00-16.5-D (6.0)

STD

8.00-16.5-E (6.0)

EXT

7.50-16LT-E (6.0)

EXT

For Trailer-Tow Vehicles the minimum tire size shown is standard for GVWR's shown. The 2000 lb. (907 kg) Trailer Tow is available for all 159 inch (4038mm) Wheelbase vehicles. The 10,000 lbs. (4536 kg) Trailer Tow is available for all GVWR's.

SPECIFICATIONS**AD150, AW150**

Models		AD150		AW150			
GVWR (pounds)				5300	5850	6010	6050
TIRE		STD. WHEEL				(Canada only)	Snow Plow
P235/75R15		15x6.5	(1)	STD.	STD.	STD.	—
P255/70R15	OWL	15x7.0	(1)	\$	\$	\$	—
LR60-15B	OWL	15x7.0	(1)	—	—	\$	N.A.
10R-15LT-B	OWL	15x7.0	(1)	—	—	(3)	N.A.
P235/75R15-XL		15x6.5 H.D.		—	—	\$	\$
7.00R-15LT-D		15x6.5 H.D.		—	—	\$	\$
TRAILER TOWING							
AHC (TRAILER TOWING PREP. PKG.)		(2)		(2)	(2)	(2)	N.A.

Spare Wheel and Tire Standard

(1) 15x7.0 Styled Wheel Available—Extra Cost

(2) Same Equipment as Without AHC

(3) 10R-15C Required—Canada only

(\$) Extra Cost Option

TIGHTENING REFERENCE

Nut Type	Thread Size	Torque	
		Ft. Lbs.	N-m
Cone	1/2-20	105	142
Cone	5/8-18	200	271
Flanged	5/8-18	325	440

BODY

CONTENTS

	Page		Page
DOOR SYSTEMS	19	REFINISHING PROCEDURES	32
FIXED GLASS	26	SHEET METAL	9
INTERIOR TRIM	1		

INTERIOR TRIM

INDEX

	Page		Page
Bench Seat Mounting	3	Cowl Side Trim Panel	2
Bucket Seats	2	Headliner	8
Left Side	2	Interior Trim	5
Right Side	3	Model Identification	1
Lock Assembly	3	Outside Air Vent	2
Carpet and Mat Assembly	8	Rear Seat	4
Console	4	Rear View Mirror	1
Removal	4	Rear View Mirror Button	1
Installation	4	Safety Belts—Rear Seat	7
Console Lock	4	Seat Belt and Retractors	7
Removal	4	Storage Tray	8
Installation	5	Uni-Belts—Front Seat	5

Model Identification

AD = Ramcharger Two-Wheel-Drive
 AW = Ramcharger Four-Wheel-Drive
 D = Light Duty Truck Two-Wheel-Drive
 W = Light Duty Truck Four-Wheel-Drive

Rear View Mirror (Fig. 1) (All Models)

Removal

- (1) Loosen the set screw and slide the mirror up and off the button.
- (2) Installation is accomplished by sliding the mirror over the button and tightening the set screw. Care should be exercised not to over tighten the screw.

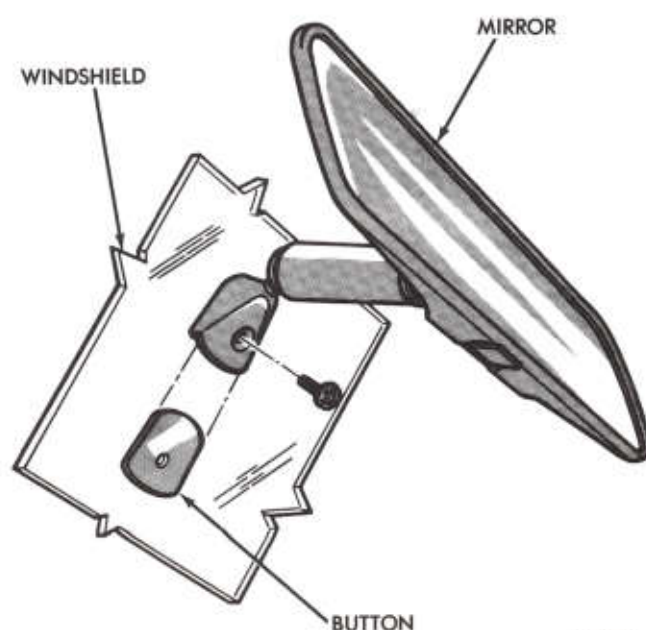
Rear View Mirror Button (Fig. 1) (All Models)

Replacement

- (1) Using a wax pencil, locate and mark the mounting position of the button on the outside of the wind-shield.
- (2) If the vinyl pad had remained on the wind-shield glass, apply "low heat" to it with an electric heat gun until the vinyl softens; then peel the vinyl pad from the glass.
- (3) Thoroughly clean the inner surface of the wind-shield glass in the mounting area of the mirror button using a mild abrasive cleaning powder such as Ajax, Comet, or equivalent, on a clean cloth saturated with alcohol. Then, apply alcohol to a paper towel and wipe off any traces of remaining cleaner.
- (4) Thoroughly sand the windshield mounting sur-

face (the side with least surface area) of the mirror button with a clean piece of fine grit sandpaper and wipe the surface clean with a clean paper towel saturated with alcohol.

- (5) Using kit 4054099 or equivalent, crush the vial in the plastic housing of the accelerator. This saturates felt applicator. Remove paper sleeve. Apply a generous amount of Accelerator on the mounting surface of the mirror button.



PR695

Fig. 1—Rearview Mirror

(6) Allow the accelerator to dry for five minutes. Do not touch the mounting surface of the button or glass.

(7) Apply a thin film of accelerator to the inner surface of the windshield in the button mounting area. Allow one minute to dry. Do not touch the surface.

(8) Apply one drop of adhesive to the center of the windshield mounting surface of the mirror button as shown on the attached sketch and, using the bottom of the Adhesive tube, quickly distribute the adhesive evenly over the entire bonding surface of the button.

(9) Position the bottom straight edge of the mirror button on the horizontal line and center it on the vertical line; then, press it firmly to the glass and apply pressure for about one minute. Proper location is essential as cement sets up very fast.

(10) Allow five minutes for the adhesive to set; then, remove any excess adhesive residue from the windshield in the attachment area using an alcohol-dampened cloth.

(11) Slide the mirror downward onto the button and tighten the screw.

Cowl Side Trim Panel (Figs. 2 and 3) (All Models)

The trim panel is secured to the cowl side panel with screws. Refer to the illustrations for screw locations.

Outside Air Vent (Figs. 2 and 4) (All Models)

The air vent is mounted on the lower side cowl (Drivers side) with mounting screws. To operate the vent push or pull handle located on the vent assembly. To remove vent assembly, remove screws and remove

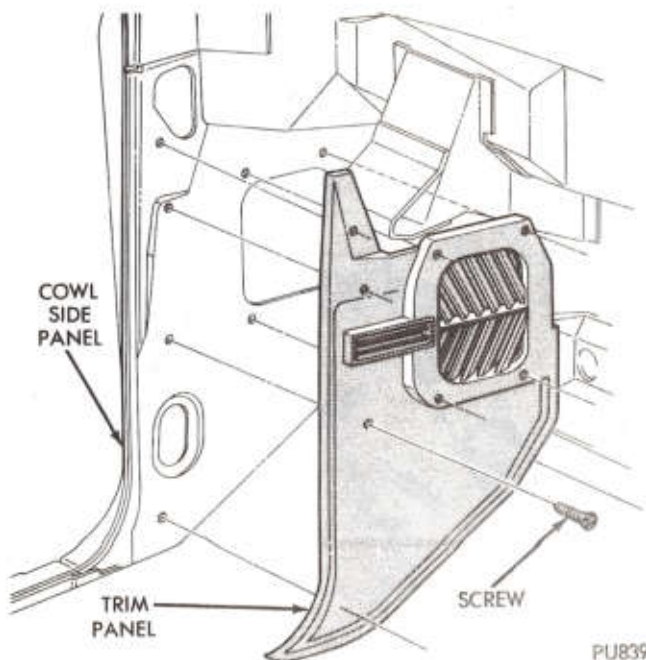


Fig. 2—Left Side Trim Panel

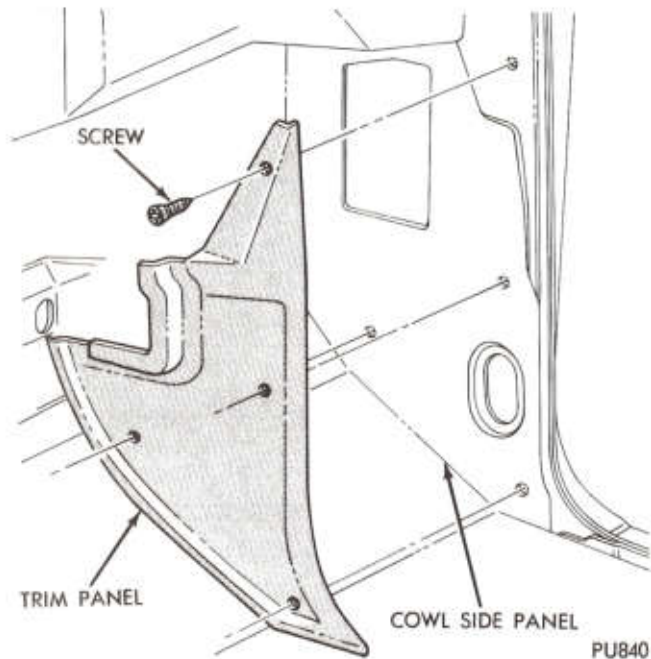


Fig. 3—Right Side Trim Panel

assembly. To install vent assembly, place assembly into position and secure with mounting screws.

Bucket Seat-Left Side (Fig. 5) (Ramcharger)

Removal

(1) To remove complete seat, adjuster, and riser, remove nuts mounting riser to underbody.

(2) To remove individual assemblies refer to the assembly in (Fig. 5).

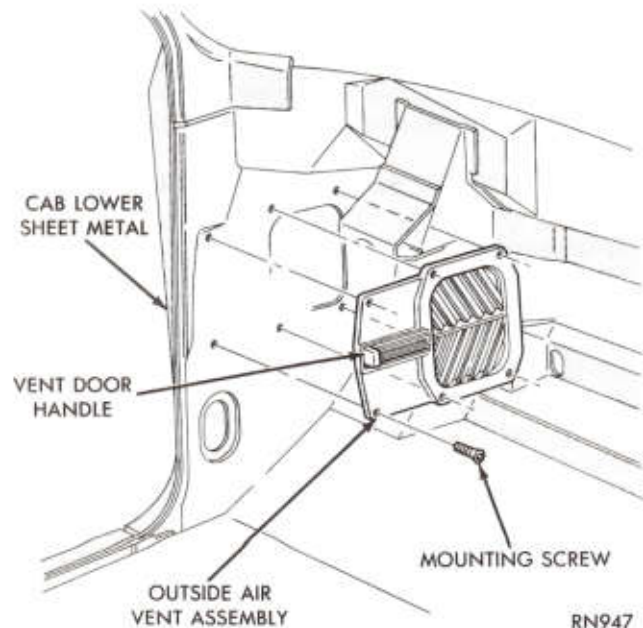


Fig. 4—Outside Air Vent

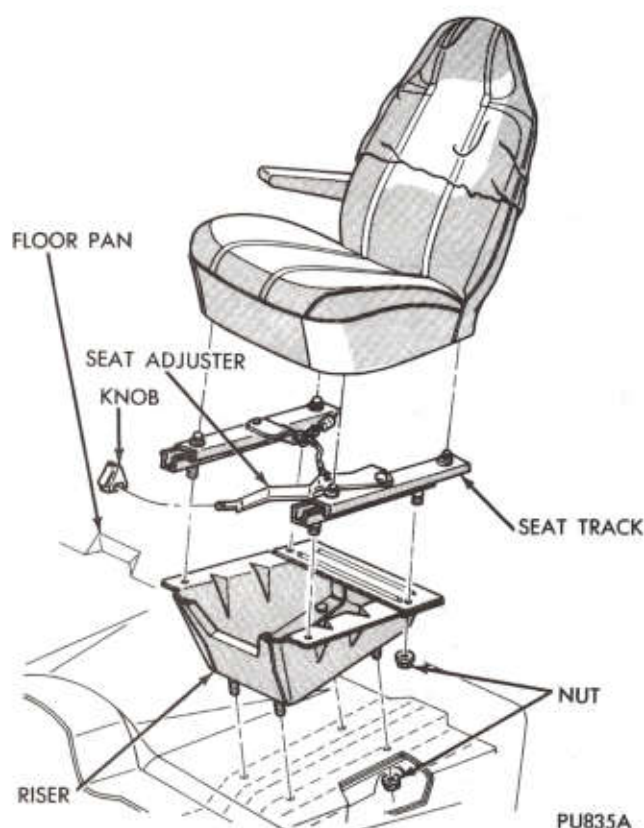


Fig. 5—Bucket Seat, Left Side

Installation

- (1) To install complete seat adjuster and riser as one assembly, place assembly into position in vehicle and secure nuts to riser located on underbody.
- (2) To install individual assemblies refer to (Fig. 5).

Bucket Seat-Right Side (Fig. 6) (Ramcharger)

The passenger seat is equipped with a tilt seat riser for access to the rear seating area. This is a gas prop operated mechanism with a lock and release lever located on the side and on the rear of the seat.

Removal

- (1) To remove the seat assembly, remove the nuts mounting the hinge section of the riser to the underbody of vehicle.
- (2) Disconnect gas prop on bottom of seat.
- (3) Release the lock from the lock catch and remove the seat assembly from vehicle.
- (4) The seat may be removed without the riser by removing bolts from seat to riser spacer.

Installation

- (1) To install seat assembly, secure the hinge section of the riser to the underbody with nuts.
- (2) The seat can be installed by mounting seat to riser spacers.
- (3) Connect gas prop to seat.

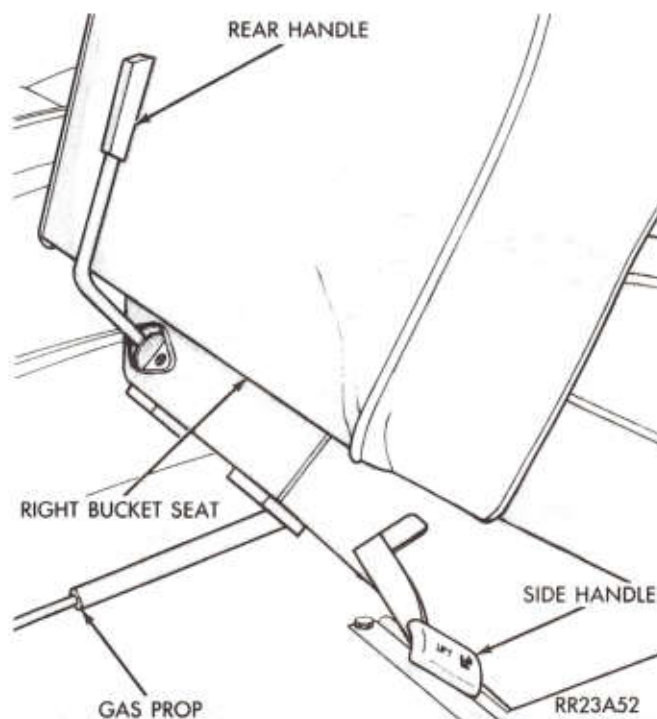


Fig. 6—Bucket Seat, Right Side

- (4) Lock should line up with lock catch mounted on the underbody.

Lock Assembly

Removal

- (1) To remove lock from riser, remove screws securing lock to riser.
- (2) Remove clip from inside end of link.
- (3) Remove lock from riser.

Installation

- (1) Install lock to riser.
- (2) Install linkage to lock lever clip.
- (3) Adjust lock to eliminate vertical freeplay at rear of seat.

Lock Catch

The lock catch is mounted to the underbody with screws. To remove lock catch, remove screws and remove catch.

The lock catch can be adjusted with slotted holes in mounting area.

Latch Lever

The latch lever assembly has a knob, lever handle, escutcheon, spring pin and snap ring. For removal or installation of assembly, refer to view 'C' of (Fig. 6).

Bench Seat Mounting—All Models (Fig. 7)

Bench seats are mounted to the floor pan with fasteners accessible from underneath the vehicle. Refer to (Fig. 7) for mounting locations.

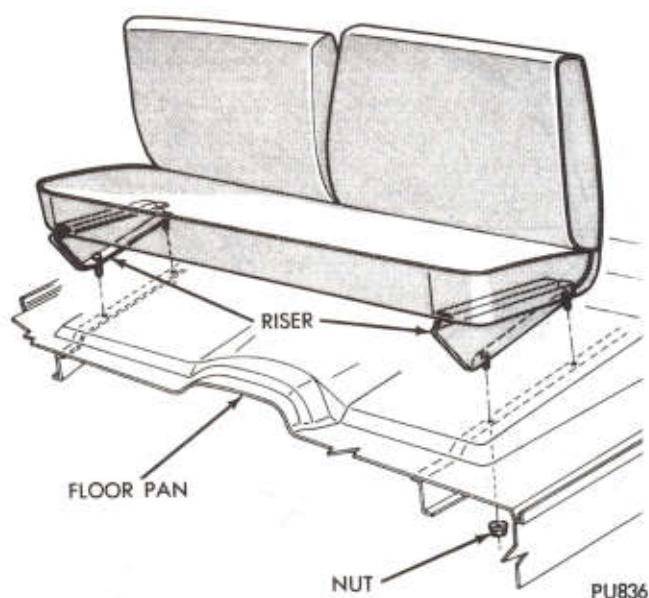


Fig. 7—Bench Seat Mounting

Rear Folding Seat (Figs. 8, 9, and 10)—AD, AW

The rear seat is mounted to the underbody with studs mounted through brackets on the seat. For removal or assembly refer to (Fig. 10). Operation is accomplished by releasing seat latch and folding seat over and upward. The seat is retained in its folded position by relocating seat belt tip half out from between seat cushion and back. Pull tip half over top of seat and attach to buckle half as shown in Fig. 8.

Console (Fig. 11) (All Models)**Removal**

- (1) Open console door.
- (2) Remove liner assembly.
- (3) Located in the bottom of the console, are screws

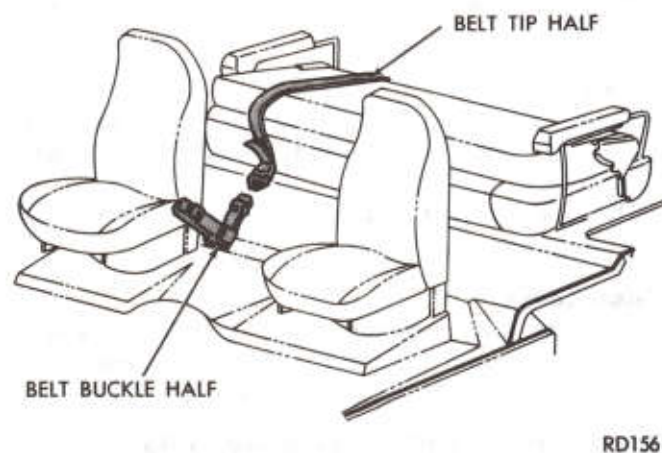


Fig. 8—Folding Rear Seat Retention

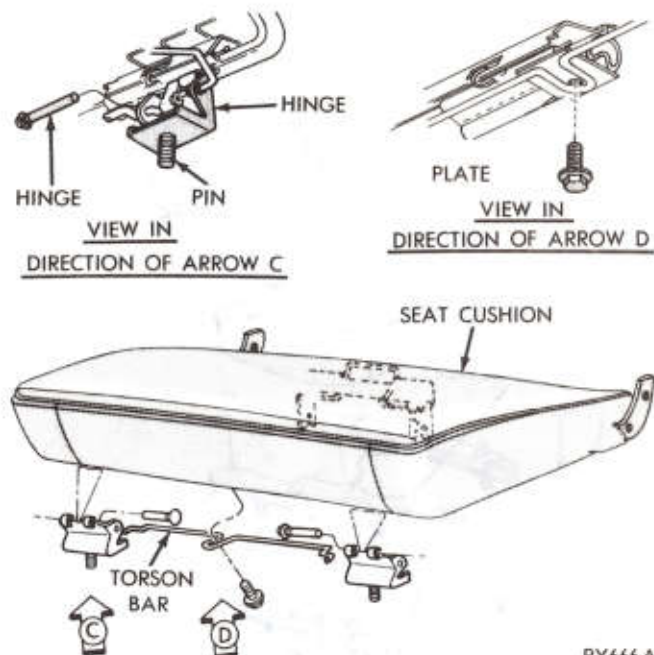


Fig. 9—Folding Seat Cushion

mounting console to underbody, remove these screws.
(4) Remove console from vehicle.

Installation

- (1) Place console into position in vehicle.
- (2) Secure console with mounting screws.
- (3) Insert liner into console.
- (4) Close console door.

Console Lock**Removal**

- (1) Open console door.

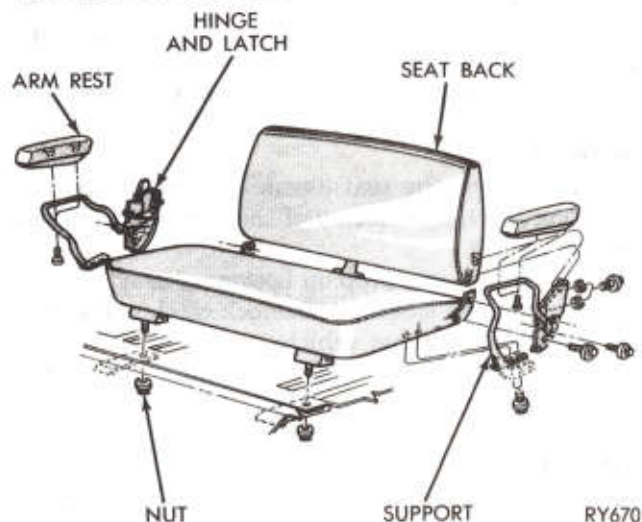


Fig. 10—Folding Seat Mounting

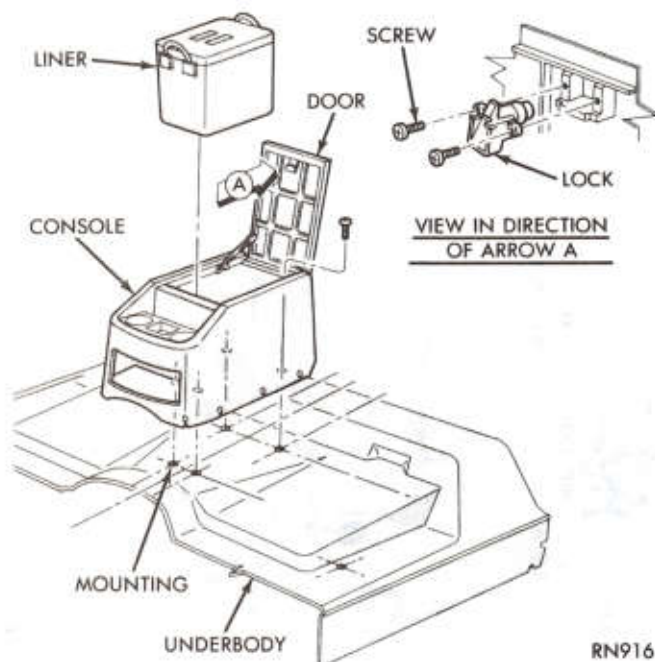


Fig. 11—Console

- (2) Remove mounting screws on inner portion of door.
- (3) Remove lock from door.

Installation

- (1) Place lock into position in door.
- (2) Secure with mounting screws.
- (3) Close door and check for correct latching and key cylinder operation.

Interior Trim (Fig. 12) AD, AW

The side trim right and left is mounted with screws

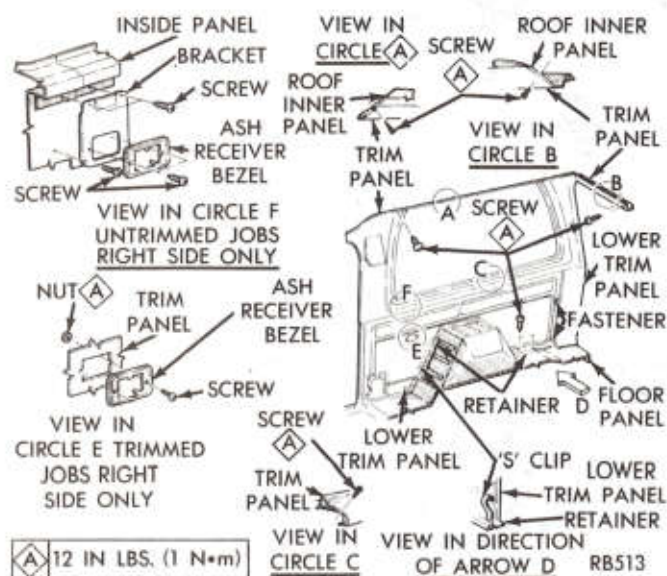


Fig. 12—Interior Trim AD, AW

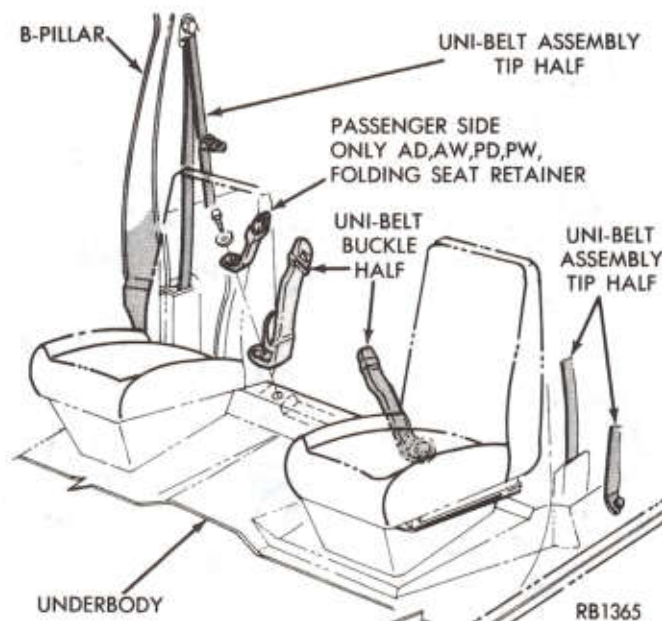


Fig. 1—Uni-Belt Front Seat Attachment AD, AW

to the side panel interior. The floor mat or carpet overlaps the bottom edge of the trim panel. Refer to (Fig. 12) for removal or installation of the side trim panel.

Uni-Belts—Front Seats AD, AW, D, W

The uni-belts are mounted to the 'B' pillar as shown in (Figs. 1 and 3). The buckle half is located on the inboard side of the seat, mounted to the underbody. The 'B' pillar half of the belt is secured with bolts torqued to 350 inch pounds $\pm$ 150 inch pounds (40 N·m $\pm$ 17 N·m).

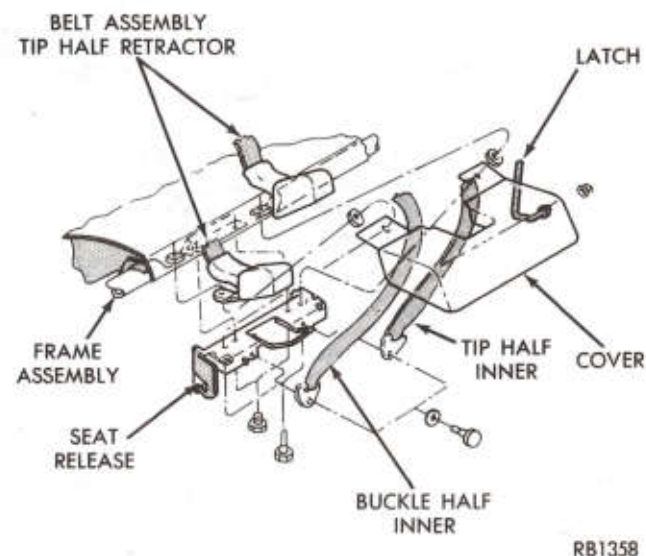
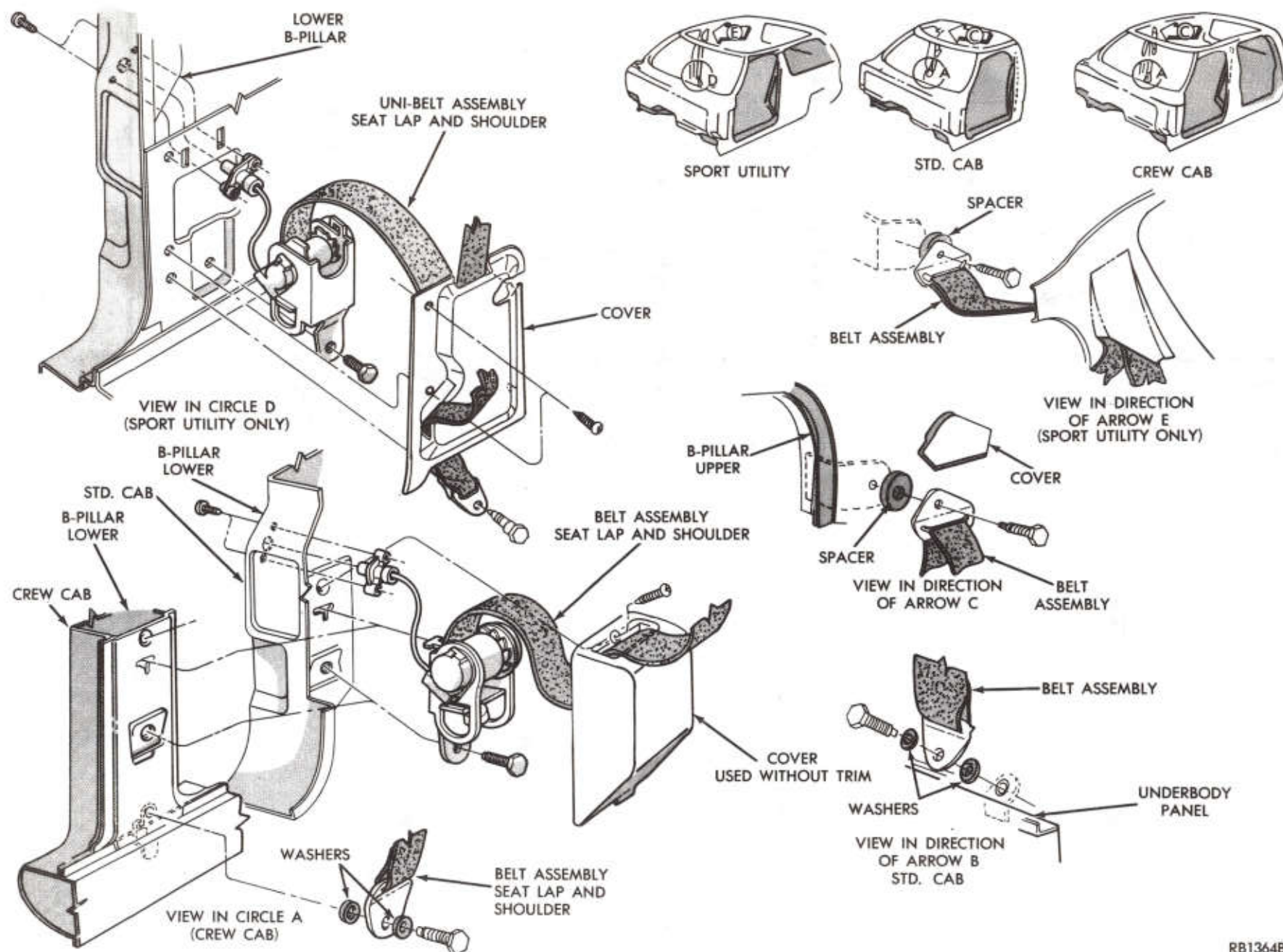


Fig. 2—Seat Belt Mounting Folding Rear Seat, AD, AW



RB1364B

Fig. 3—Uni-Belts Front Seat AD, AW, D, W

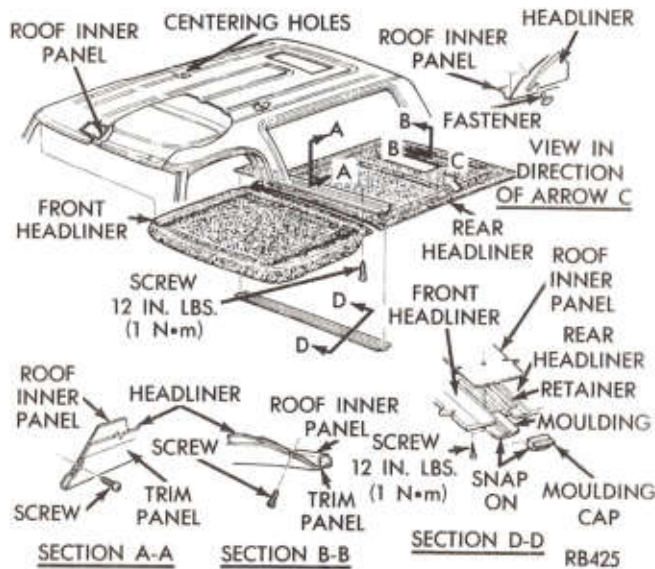


Fig. 4—Headliner AD, AW

Safety Belts—Rear Seat (Fig. 2) AD, AW

The rear folding bench seat (Fig. 2) is available with the outboard buckles mounted to the underbody and inboard retractors mounted on the seat frame rear cross member. The center buckle tip half is mounted to the latch mechanism. Torque the belt bolts to 350 inch pounds $\pm$ 150 inch pounds (40 N·m $\pm$ 17 N·m).

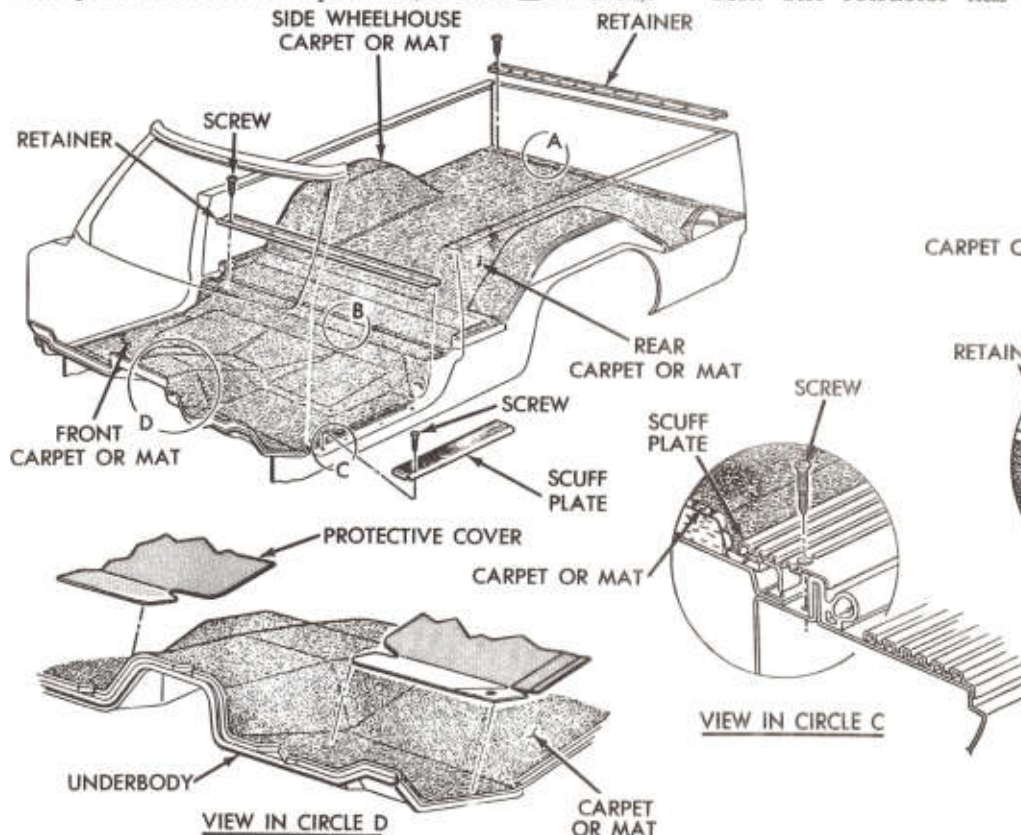


Fig. 6—Carpet or Mat Assembly (Typical)

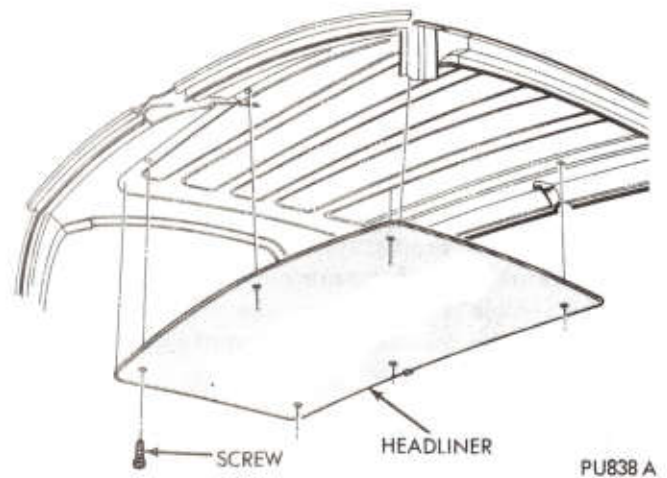


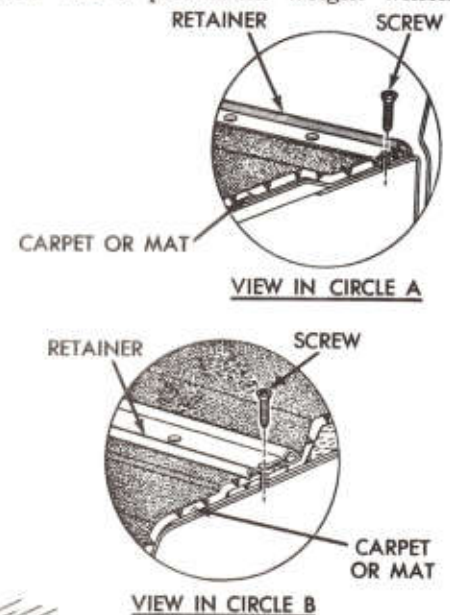
Fig. 5—Typical D, W Headliner

Seat Belts and Retractors

For assembly and views refer to (Figs. 1, 2, 3). The center belt mountings are typical. Be sure when belts or retractors are replaced that the bolts are tightened to 350 in. lbs. $\pm$ 150 in. lbs. (40 N·m $\pm$ 17 N·m) for safety requirements.

Seat Belt and Harness Operation (All Models)

A hard pull on the shoulder belt will NOT lock the belt. The retractor has a pendulum weight which



locks the shoulder belt during rapid deceleration of the vehicle.

Belts from different models are not interchangeable and no attempt should be made to mix belt lengths.

Safety belts should be worn whenever the vehicle is in motion. The operation and mounting of the belts should not be tampered with at any time. When removal, installation, or repair is necessary, refer to illustrations for proper system locations and mounting hardware. If the belts are removed for any reason, and the vehicle is to be driven, the seat belt retaining bolts should be reinstalled to prevent exhaust fumes from entering the vehicle.

Headliner—All Models (Figs. 4 and 5)

The headliner is mounted to the roof panel with screws. On AD, AW models the headliner is two piece and is joined by a push on moulding.

Carpet or Mat Assembly—Front and Rear (Fig. 6)

Removal

- (1) Remove seats, front and rear.
- (2) Remove retainers and scuff plates.
- (3) Remove front floor protective covers.
- (4) Remove storage tray 4 (four screws).
- (5) Remove mat or carpet, front and rear from vehicle.

Installation

- (1) Place carpet or mat into position and secure front and rear.

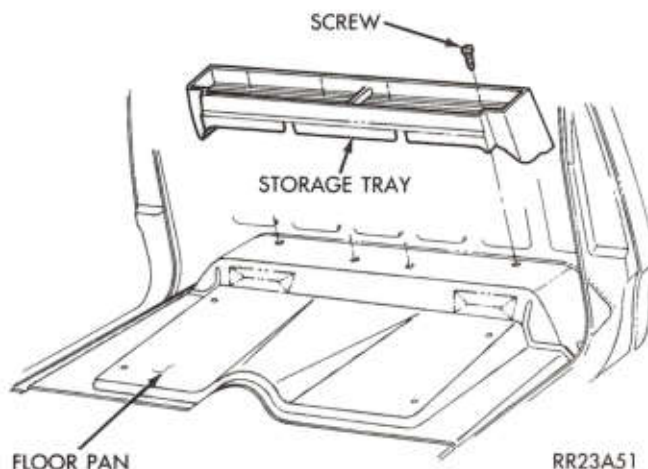


Fig. 7—Storage Tray

- (2) Install retainers and scuff plates.
- (3) Install protective covers.
- (4) Install storage tray 4 (four screws).
- (5) Install seat front and rear.

Storage Tray (Fig. 7)

The storage tray is located behind the front seat on all pickups. The tray is secured to the floor pan by four (4) screws.

Installation and Removal

- (1) Position tray on floor pan.
- (2) Insert four (4) screws.
- (3) For removal, reverse the above procedure.

SHEET METAL

INDEX

	Page		Page
Battery Tray and Brace	13	Latch and Striker	11
Bolt Torque	18	Removal	11
Bumpers	9	Hood Release (Inside)	9
Rear Bumpers—Step and Non-Step	9	Liftgate	14
Cowl Grille Attachment	13	Liftgate Hardware	14
Front End Mounting	13	Lock Latch Assembly	14
Grille	11	Hinge—Liftgate	14
Hold Down Mounting	14	Lift Rod	14
Hood	10	Radiator Core Support, Fender and Splash Shield ..	12
Adjustments	10	Roll Bar Assembly	18
Hinge Replacement	11	Tailgate	17
Hood Alignment (Fore and Aft)	10	Tailgate to Body	17
Installation	11	Tailgate, Lock and Linkage	17

Model Identification

AD = Ramcharger Two-Wheel-Drive
 AW = Ramcharger Four-Wheel-Drive
 D = Light Duty Truck Two-Wheel-Drive
 W = Light Duty Truck Four-Wheel-Drive

BUMPERS

Front (Fig. 1)

Removal

- (1) Remove bumper guard (if so equipped).
- (2) Remove bumper to bracket fasteners and lift bumper off of mounting brackets.
- (3) Reverse above procedure for installation.

Front Bumpers

Place the brackets to the bumper, assemble with bolts, plain washer, lock washer and nuts. Line up the bumper brackets with the holes in the frame and secure with bolts, nuts, and washer. When the assembly is mounted to the vehicle, check the alignment to

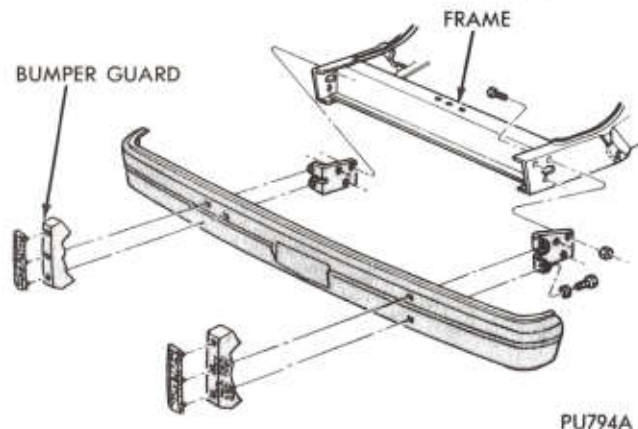


Fig. 1—Front Bumper, All

body sheet metal. For assembly procedures refer to (Fig. 1).

Rear

Removal (Fig. 2)

- (1) Remove bumper guards (if so equipped).
- (2) Remove bumper to bracket fasteners and lift bumper off of mounting brackets.
- (3) Reverse above procedure for installation.

Rear Bumpers—Step and Non-Step

The rear bumper is mounted to brackets in the same manner as the front bumpers. The assembly is then mounted to the chassis with bolts and nuts. Check to see that there is proper alignment with body sheet metal. See (Fig. 3) for installation.

HOOD RELEASE (INSIDE) (Figs. 4 and 5)

Removal

- (1) Open hood and remove hood lock shield.

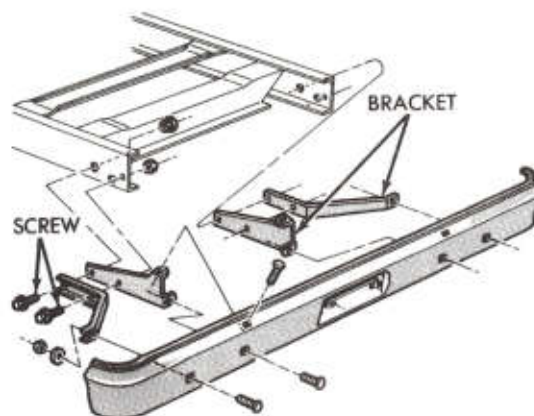


Fig. 2—Rear Bumper, Standard

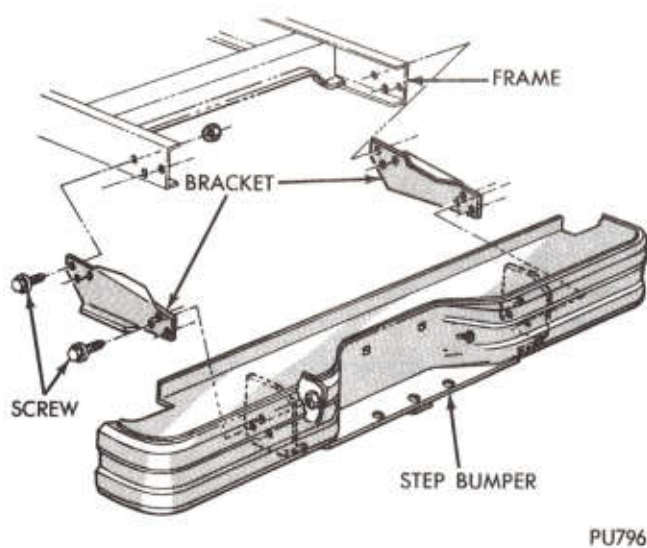


Fig. 3—Step Bumper, All

(2) Disconnect hood latch release cable from latch assembly.

(3) Release cable assembly from routing clip along body sheet metal.

(4) Remove grommet from dash.

(5) From inside the vehicle remove mounting screws securing release handle to lower section of instrument panel.

(6) Route the hood release cable assembly out of the dash and remove from vehicle.

Installation

(1) From inside, route the hood release cable assembly through the dash.

(2) Mount the release handle to the lower section of the instrument panel.

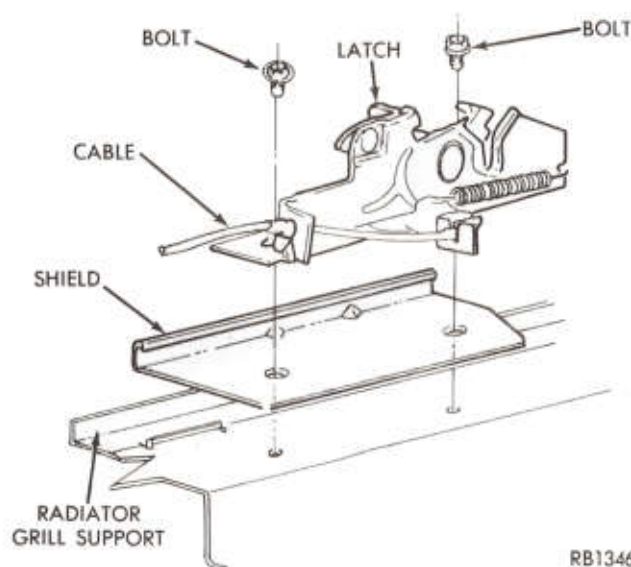


Fig. 4—Latch and Cable Mounting

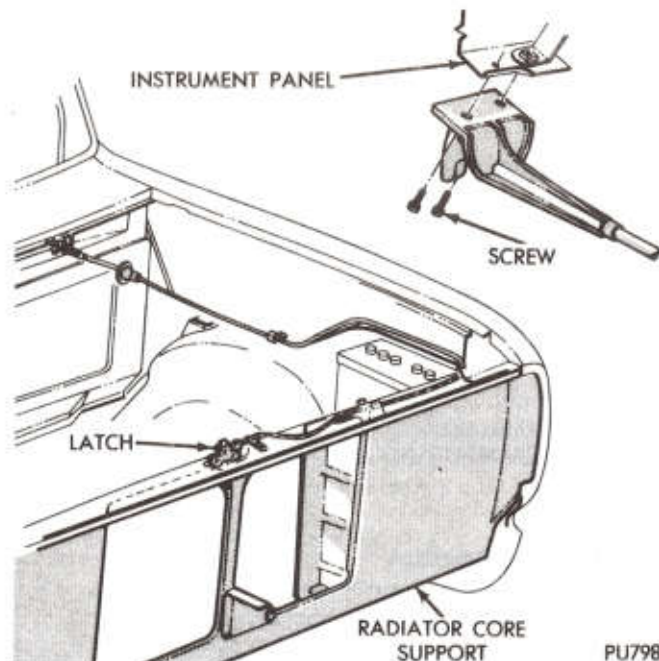


Fig. 5—Cable Routing

(3) Install grommet to dash panel.

(4) Secure the cable to the rear routing clip along the body sheet metal.

(5) Route the cable over the support flange and connect the cable to the latch assembly. Install the lock assembly cover.

(6) Adjust the cable to shroud clip to insure slack between the clip and the latch.

(7) Test hood latch release for proper function.

HOOD

Adjustments (Figs. 6 and 7)

The hinge screw holes are oversized and elongated to permit up and down adjustment and "fore" and "aft" adjustment at the hood.

The hinge mounting at the fender panel provides up and down adjustment (Fig. 7).

Hood Alignment (Fore and Aft)

The following sequence of hood alignment, lock and striker adjustment must be followed. An improperly adjusted lock or striker could cause the hood to open to the safety catch.

(1) Loosen both hinge mounting bolts at hood mounting.

(2) Loosen hood latch from grille support.

(3) Close hood and adjust so approximately 3/16 inch clearance is obtained between back of hood and cowl.

(4) Raise hood to approximately 30 degrees and tighten hinge to hood mounting bolts.

(5) Tighten latch, and lower the hood and check

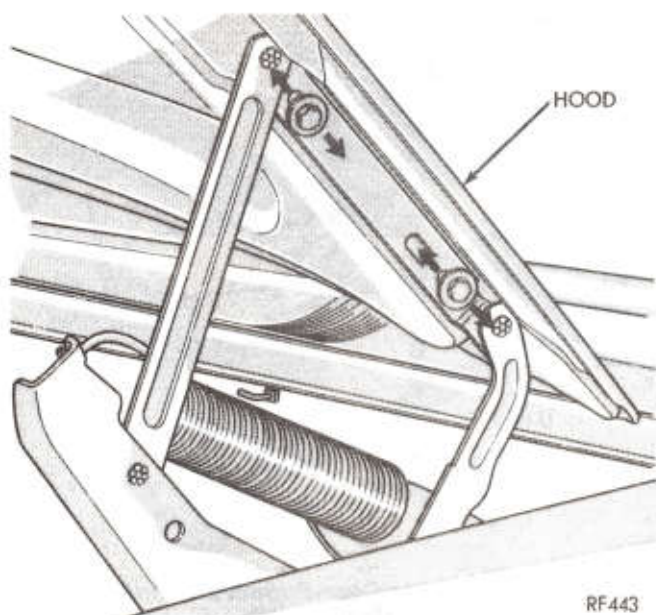


Fig. 6—Hood Adjusting Points

visually for proper front fender pad pressure.

(6) Open the hood. Using a substance such as clay or other suitable material capable of receiving an impression, coat top side of primary latch striker arm. Close hood to obtain a full latch position.

(7) Disengage hood latch and check latch imprint in substance used. A properly adjusted latch will show a centered position on striker. If imprint is not proper, readjust hood latch.

Removal

(1) Raise hood to full open position.

(2) With an assistant remove the bolts and remove the hood from vehicle.

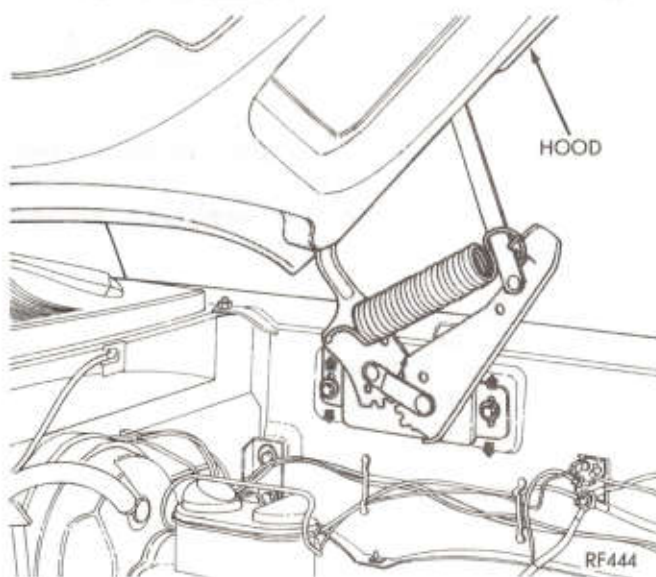


Fig. 7—Hinge Adjusting Points

(3) If new hood is to be installed, remove all serviceable components from old hood.

(4) Inspect hood hinges for proper operation and wipe clean with a suitable solvent.

(5) Lubricate hood hinges with a suitable lubricant.

Installation

(1) Install all serviceable components from old hood and any new parts as necessary.

(2) With an assistant position hood on vehicle and align holes to hinge, install bolts snugly but do not tighten.

(3) To align hood, latch, and striker, see steps (1) thru (7) under Hood Alignment.

Hinge Replacement

(1) Raise hood to full open position and loosen hood hinge bolts.

(2) Support the hood on the side the hinge is being removed from. Remove the hinge.

(3) Position new hinge against fender shield and install bolts and tighten snugly.

(4) Align hood to hinge, install bolts snugly, do not tighten.

(5) To align hood, latch, and striker see steps (1) thru (7) under Hood Alignment.

When both hinges are to be replaced, remove the hood and hinges as an assembly.

Latch and Striker

Removal

(1) Raise hood and remove hood latch attaching bolts.

(2) Remove hood latch assembly.

(3) Loosen and remove attaching bolts of striker assembly and remove striker from grille support.

Installation

When installing a new latch, make sure assembly is well lubricated.

(1) Position latch assembly and install bolts. The mounting holes are elongated to allow lateral and vertical adjustment.

(2) Position striker assembly and install bolts, but do not tighten.

Adjustment

To adjust hood latch and striker see steps 1 through 7 under Hood Alignment.

GRILLE (Figs. 8 and 9)

Removal

(1) Remove grille upper attaching screws.

(2) Remove lower grille attaching screws.

(3) Remove attaching screws located at each end of grille.

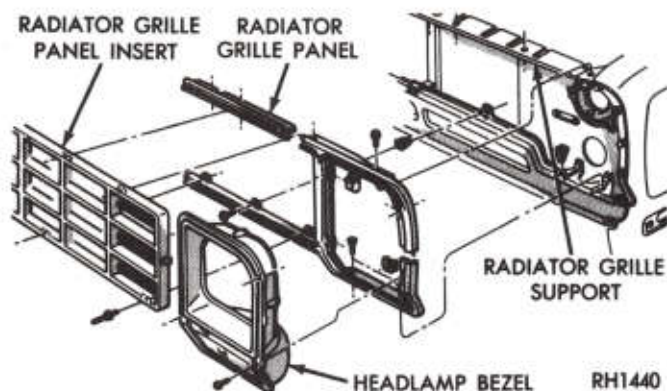


Fig. 8—Grille, Square Headlamp Type

(4) Remove lower grille attaching screws (grille to extension).

(5) Remove attaching screws at each end of grille extension.

Installation

(1) Place grille extension in opening and install sheet metal screws loosely.

(2) Center grille extension and tighten screws.

(3) Place grille in opening and center, and install screws.

RADIATOR CORE SUPPORT, FENDER, AND SPLASH SHIELD

The radiator core support and fender assembly attach with "U" nuts, screws and nuts. The splash shield mounts on the inner side of sheet metal with screws.

Radiator Core Support (Fig. 10)

Removal

(1) Raise hood and remove battery.

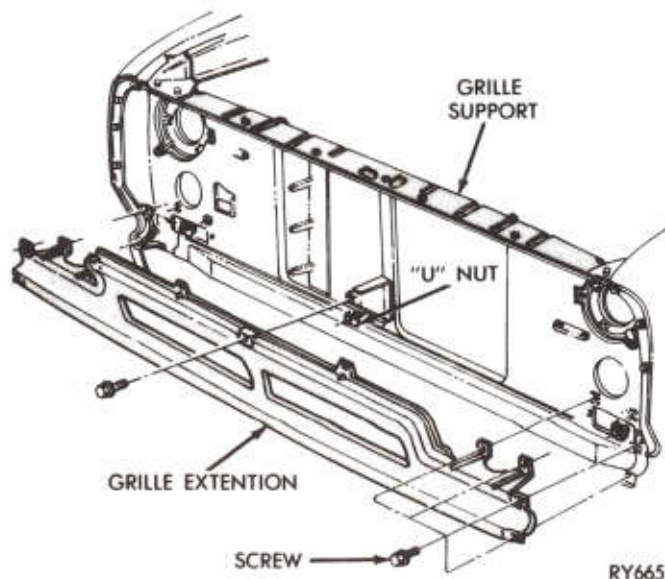


Fig. 9—Grille Extension

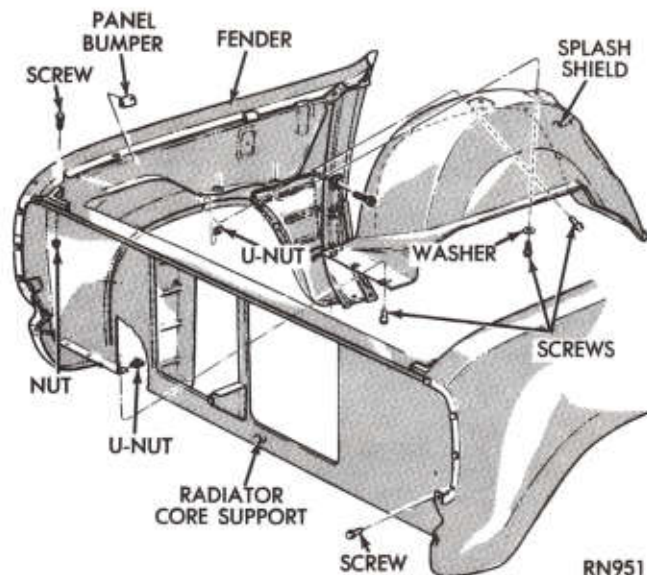


Fig. 10—Radiator Core Support, Fender and Splash Shield

(2) Drain and remove radiator (save coolant).

(3) Remove headlamp bezels.

(4) Remove upper and lower grille panels.

(5) Remove headlamps.

(6) Disconnect battery tray from radiator core support panel.

(7) Remove horns.

(8) Remove screws attaching splashshield to support.

(9) Remove front end sheet metal mount system, including studs.

(10) Remove screws from right fender to right splashshield so that right fender panel can swing out, pivoting at the cowl, allowing disengagement from radiator core support panel.

CAUTION: Care must be taken to avoid damage to fender or cowl panel.

(11) Remove radiator core support panel.

Installation

(1) Install "U" nuts on lower flange of radiator core support panel and install panel.

(2) Install screws attaching splashshield to support.

(3) Install front end sheet metal mount system.

(4) Engage right fender and secure to wheelhouse and radiator core support panel. Tighten screws.

(5) Install horns.

(6) Install and refill radiator.

(7) Attach battery tray to radiator core support panel.

(8) Install and aim headlamps.

(9) Install lower and upper grille panels.

(10) Install headlamp bezels.

(11) Install and connect battery.

Cowl Grille (Fig. 11)

Removal

- (1) Remove wiper arms.
- (2) Raise hood.
- (3) Remove mounting screws.
- (4) Disengage rear of grille from windshield weatherstrip and remove grille.
- (5) Reverse above procedure for installation.

BATTERY TRAY AND BRACE (Fig. 12)

Removal

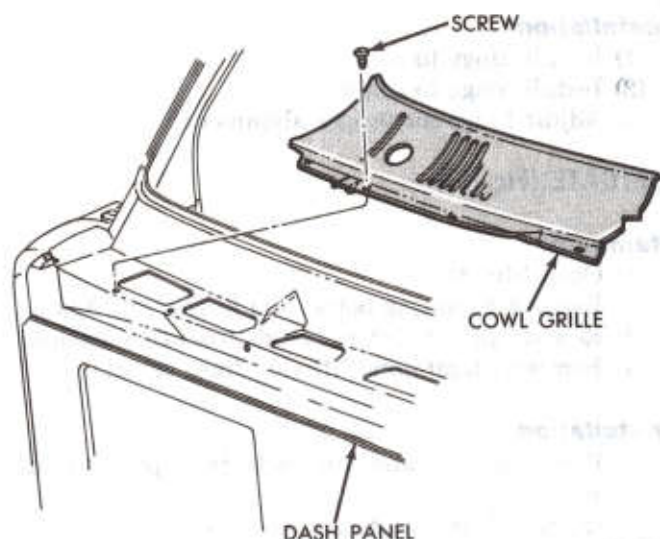
- (1) Disconnect battery cables.
- (2) Remove battery hold downs and remove battery from tray.
- (3) Remove "C" nut and screw from lower brace to tray attachment.
- (4) Remove brace from fender housing support.
- (5) Remove tray from front end sheet metal.

Installation

- (1) Place "U" nuts on tray assembly and align to holes.
- (2) Place tray into front end sheet metal.
- (3) Attach with screws, washers and nuts.
- (4) Position brace to fender housing support and secure with "C" nut, screw and washer.
- (5) Position lower end of brace to battery tray.
- (6) Secure with "C" nut, screw, and washer.
- (7) Install battery and battery hold downs.
- (8) Connect battery cables to battery posts.

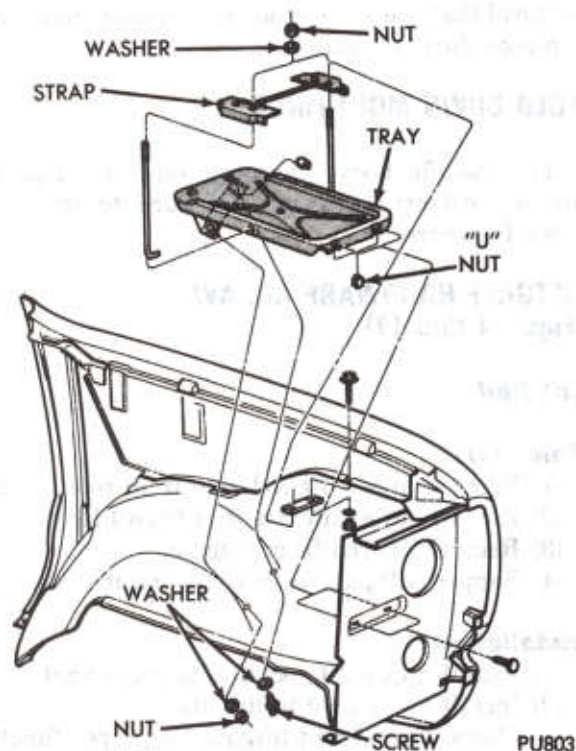
Front End Mounting (Fig. 13)

The front end sheet metal attaches to the body with spacers between the rear of fender and cowl, to achieve sheet metal alignment at the cowl plenum and grille. For mounting of sheet metal front end to



PU802

Fig. 11—Cowl Grille

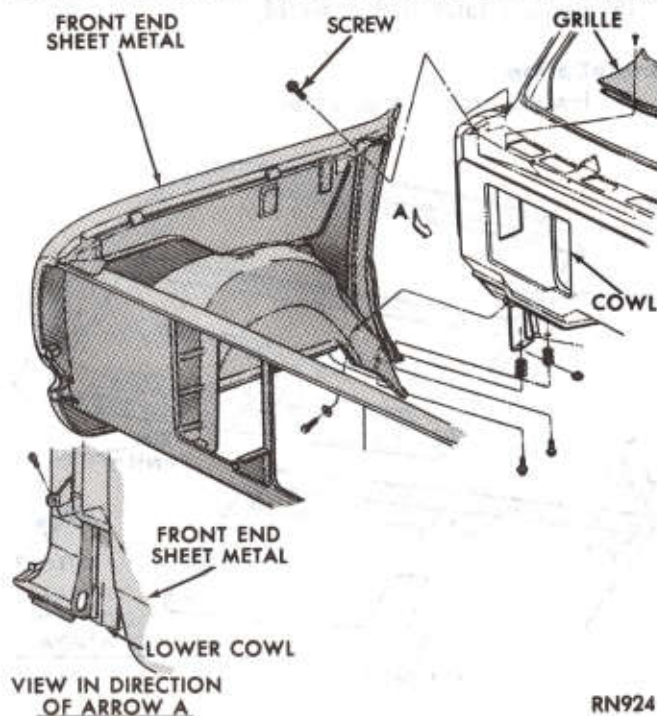


PU803

Fig. 12—Battery Tray

cowl and cowl grille refer to (Fig. 13).

Be sure to note that the fender end is mounted in two different manners to the sheet metal. One way shown is with the use of two studs and the other is using a stud on the lower mounting and a 5/16-18 x 1-1/4 screw and washer in the top mounting with spacers used under either method. Be sure during



RN924

Fig. 13—Front Fender to Body and Cowl

removal that the same amount of spacers removed are replaced during installation.

HOLD DOWN MOUNTINGS

For specific body mounting refer to (Fig. 18) to identify correct hardware. Be sure to torque hold down fasteners.

LIFTGATE HARDWARE AD, AW (Figs. 14 thru 17)

Lift Rod

Removal

- (1) Remove upper lift rod stud from roof panel.
- (2) Remove lower lift rod stud from liftgate.
- (3) Remove lift rod from liftgate.
- (4) Support liftgate when removing lift rod.

Installation

- (1) Install upper lift rod stud to roof panel.
- (2) Install lower stud to liftgate.
- (3) Check lift rod and liftgate for proper function.

LATCH LOCK ASSEMBLY (Fig. 16)

Removal

- (1) Open liftgate.
- (2) Remove liftgate trim panel (Fig. 14).
- (3) Remove latch lock cover (Fig. 16)
- (4) Disengage right and left latch tubes (Fig. 16).
- (5) Disconnect liftgate ajar wiring (Fig. 15).
- (6) Remove latch lock assembly.

Installation

- (1) Install latch lock assembly.

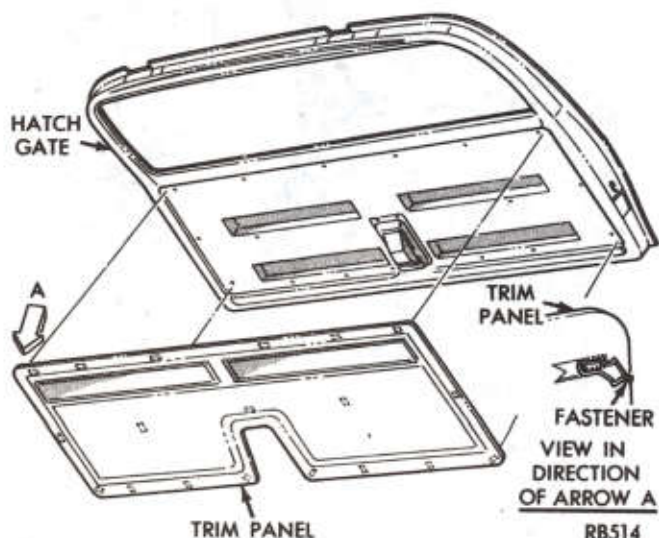


Fig. 14—Liftgate Trim Panel

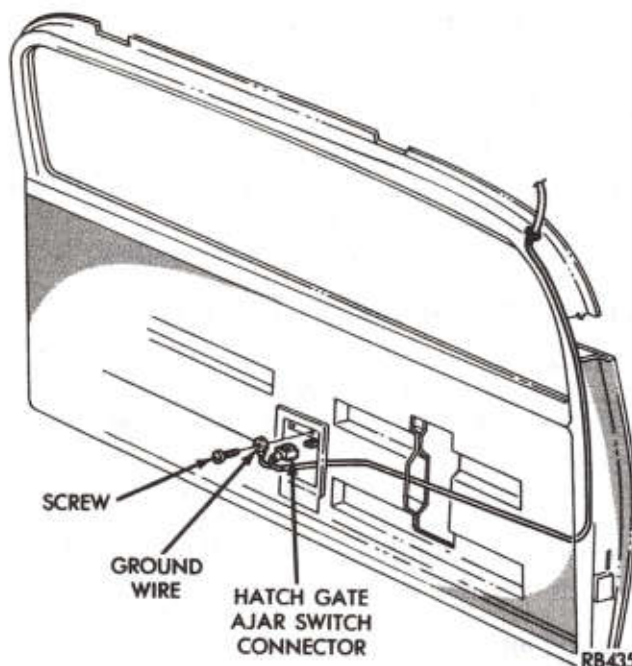


Fig. 15—Liftgate Ajar Connection

- (2) Engage right and left latch tubes to latch lock.
- (3) Check ajar switch wiring for installation.
- (4) Install latch lock cover.
- (5) Install liftgate trim panel.
- (6) Check lock and latch for proper operation.

HINGE—LIFTGATE (Fig. 17)

Removal

- (1) Support liftgate when removing a hinge.
- (2) Remove hinge to liftgate bolts.
- (3) Remove hinge to roof bolts.
- (4) Remove hinge assembly.

Installation

- (1) Install hinge to roof.
- (2) Install hinge to liftgate.
- (3) Adjust hinge for proper alignment.

LIFTGATE (Fig. 17)

Removal

- (1) Open liftgate.
- (2) Remove mounting bolts from hinges to liftgate.
- (3) Remove liftgate lift rod studs from roof section.
- (4) Remove liftgate and lift rods from vehicle.

Installation

- (1) Place liftgate and lift rods into position on vehicle.
- (2) Install lift rod studs into roof section.
- (3) Install liftgate to hinges.
- (4) Check for alignment and proper operation.

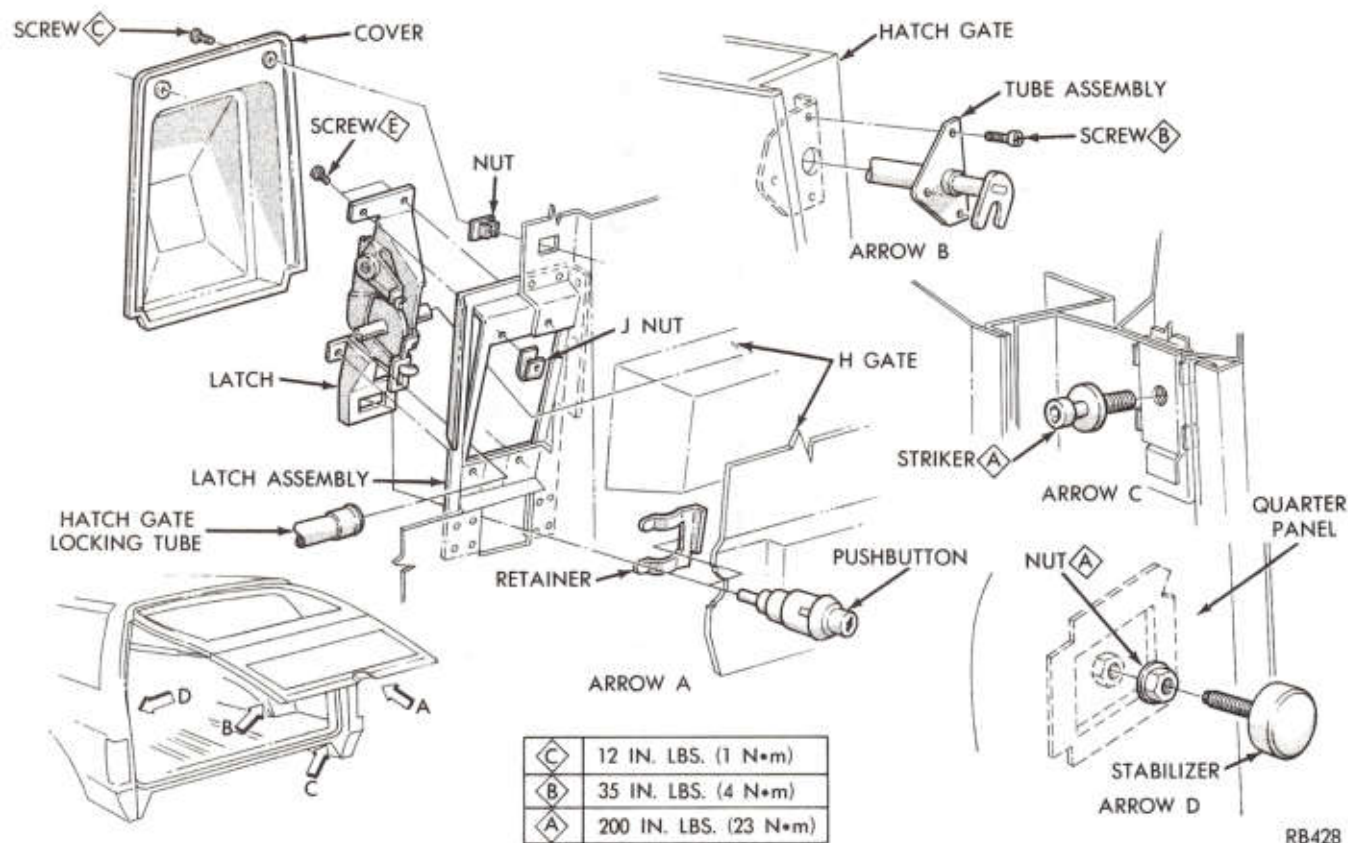


Fig. 16—Liftgate Latch and Striker

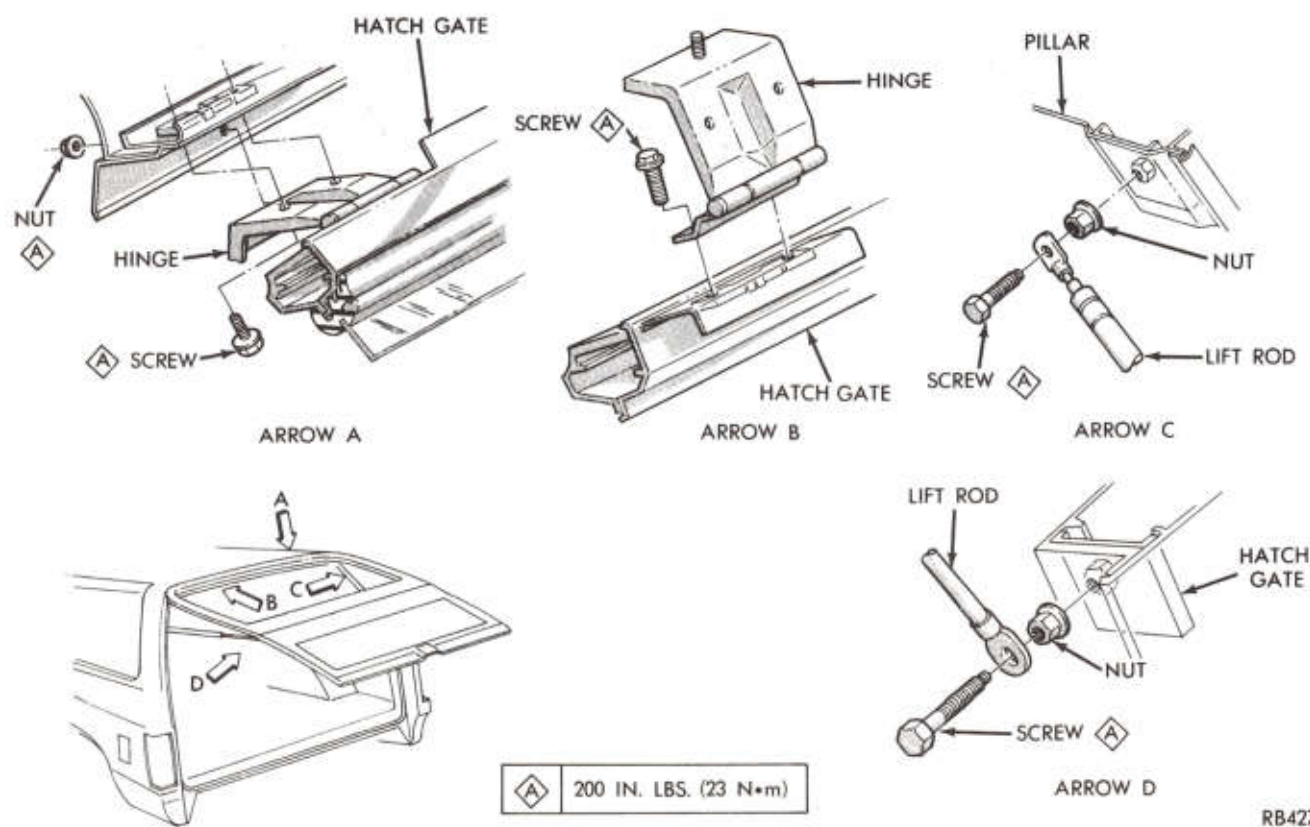


Fig. 17—Liftgate Installation

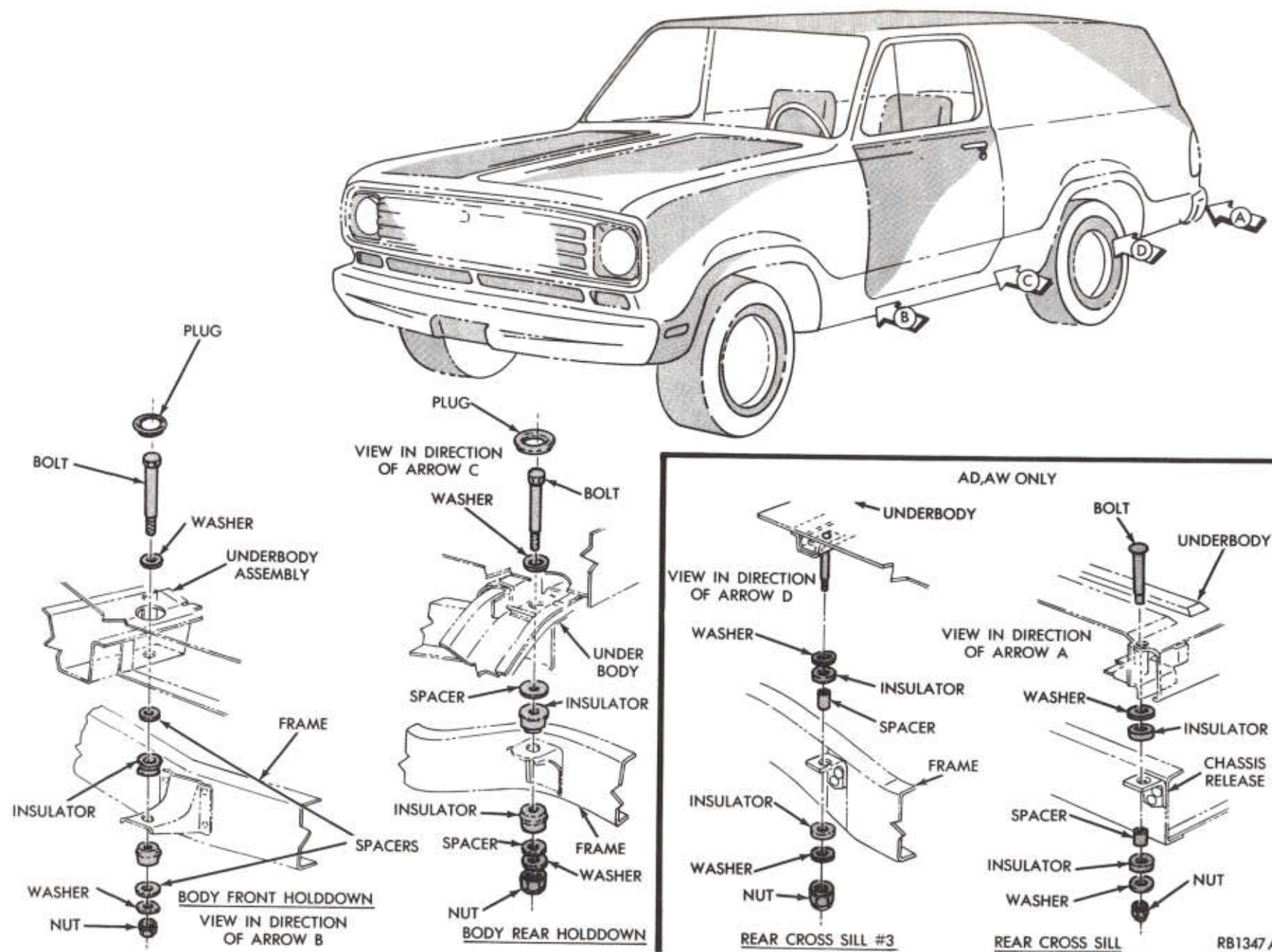


Fig. 18—Body Hold-Down Mounting AD, AW, D, W

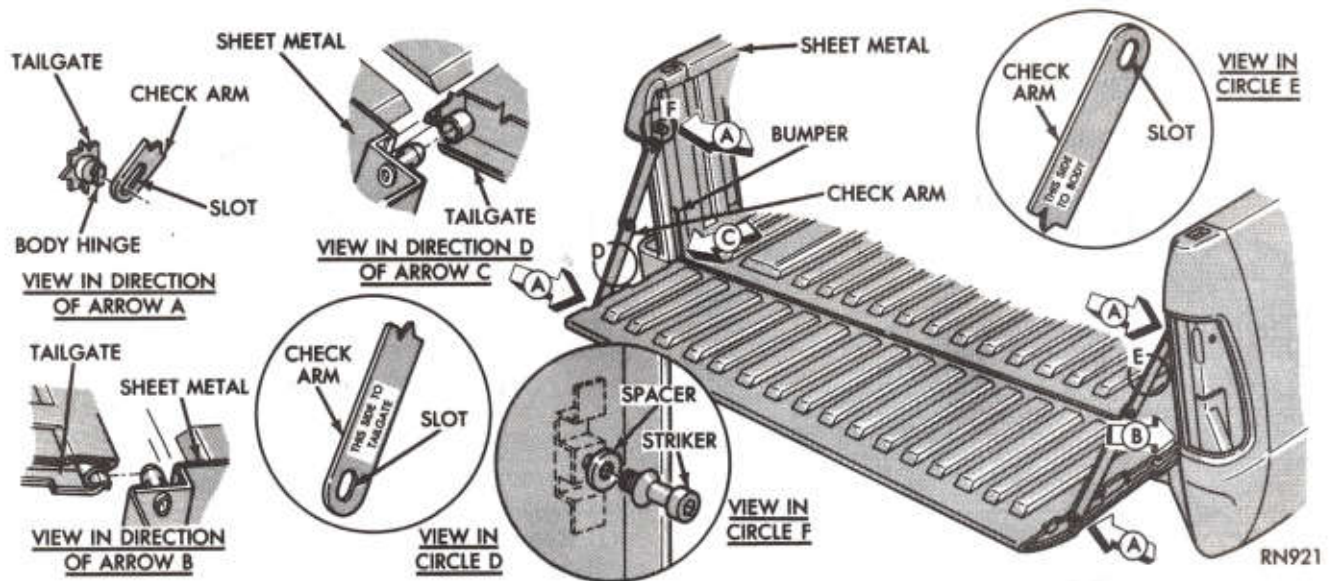


Fig. 19—Tailgate to Body D, W

TAILGATE D, W

Tailgate to Body (Fig. 19)

Removal

- (1) Open tailgate.
- (2) Angle gate so slot in check arm lines up with body hinge.
- (3) Slip check arm away from hinge.
- (4) Remove bottom of gate from slot in lower hinge on right side, facing gate.
- (5) Remove left side of gate by sliding out of lower hinge.

Installation

- (1) Slide gate into left lower hinge.

- (2) Place right side into slotted hinge.
- (3) Install check arms to gate, noting marking to correct position of arm and body.
- (4) Bring gate up till top of check arm slotted section slips onto hinge.

Tailgate, Lock, and Linkage (Fig. 20)

Removal

- (1) Remove screws mounting lock to inner tailgate sheet metal.
- (2) Lower handle and lock assembly out of opening in front tailgate sheet metal.
- (3) Disconnect clip from lock to linkage.
- (4) Remove striker plates on left and right ends of tailgate.

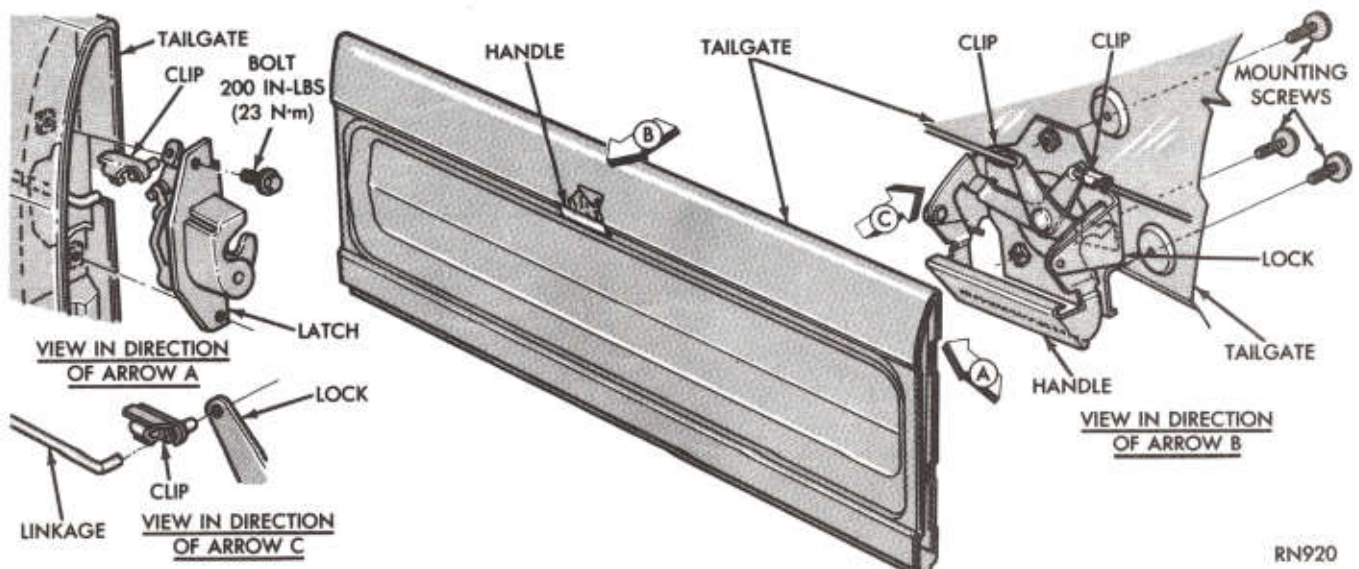


Fig. 20—Tailgate Linkage

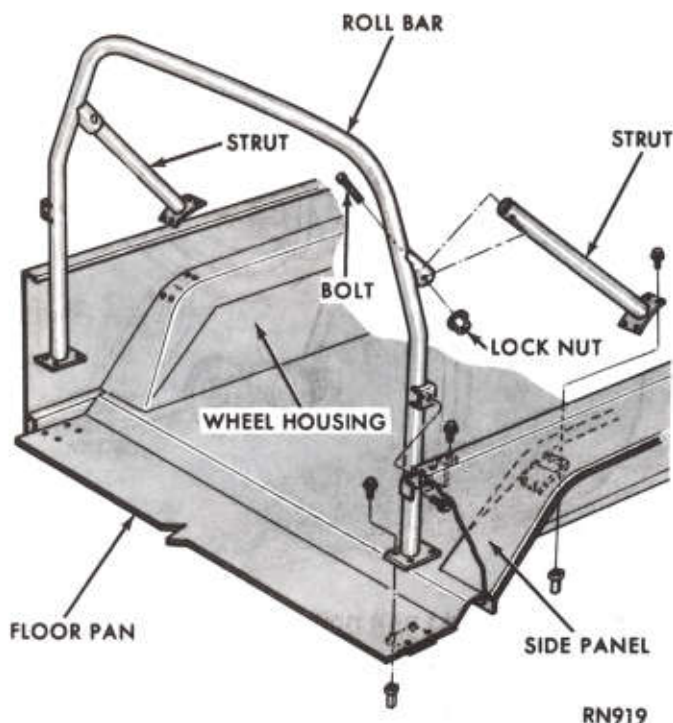


Fig. 21—Roll Bar Assembly

- (5) Remove linkage through ends of gate.

Installation

Lubricate locks before installation.

- (1) Insert lock into opening of tailgate.
- (2) Guide linkage into ends of tailgate.
- (3) Secure striker plates to end of gate.
- (4) Insert linkage into lock assembly and install clips.
- (5) Secure lock to tailgate with screws.
- (6) Check locks for proper function, adjust fore and aft to eliminate gate rattles.

Roll Bar Assembly (Fig. 21)

Removal

- (1) Remove bolts from roll bar struts, located on roll bar assembly.
- (2) Remove screws and washer assemblies from roll

SAE CLASSIFICATION		
GRADE 5		GRADE 8
	MARKINGS FOUND ON TOP OF BOLT HEAD INDICATE GRADE	
120°		60°
		RN885

Fig. 22—Bolt Head Identification

bar to floor pan.

- (3) Remove screws and washer assemblies from roll bar to side panels.

- (4) Remove screws and washer assemblies from struts to wheel housing.

- (5) Remove units from vehicle.

Installation

- (1) Install roll bar assembly loosely to floor pan.
- (2) Install roll bar assembly loosely to side panels.
- (3) Install struts to roll bar with bolts.
- (4) Install struts to wheel housing.
- (5) Secure all loose bolts and screws.

BOLT TORQUE

Size	GRADE 5		GRADE 8	
	Ft. Lbs.	N-m	Ft. Lbs.	N-m
1/4-20	95 In. Lbs.	11	125 In. Lbs.	14
1/4-28	95 In. Lbs.	11	150 In. Lbs.	17
5/16-18	200 In. Lbs.	23	270 In. Lbs.	31
5/16-24	20	27	25	34
3/8-16	30	41	40	54
3/8-24	35	48	45	61
7/16-14	50	68	65	88
7/16-20	55	75	70	95
1/2-13	75	102	100	136
1/2-20	85	115	110	149
9/16-12	105	142	135	183
9/16-18	115	156	150	203
5/8-11	150	203	195	264
5/8-18	160	217	210	285
3/4-16	175	237	225	305

DOOR SYSTEMS

CONTENTS

	Page		Page
GLASS SYSTEM	23	LATCH AND LOCK SYSTEM	19

LATCH AND LOCK SYSTEMS

INDEX

	Page		Page
Blind Rivets	19	Latch Assembly	20
Door Adjustments	19	Removal	20
Door Weatherstrips	22	Linkage Adjustment	21
Electric Door Lock Motor	22	Lock Cylinder	21
Removal	22	Door Lock Cylinder Repair	22
Front Door Trim Panel	19	Establishing Lock Cylinder Code	21
Removal	19	Lock Cylinder Procedures	21
General Information	19	Removal	21
Hinge Replacement	19		

GENERAL INFORMATION

Figure 1 is meant to serve as an index or component guide. They are meant to show component name and location. Service procedures on individual components can be found in this section also. Use (Fig. 1) as a tool to identify the part and its location on or in the door assembly.

Care should be exercised to keep all undercoating or rustproofing materials away from door components. A significant cause of door system malfunction is contamination by rust prevention materials.

Blind Rivets

The 1/4 inch blind rivets used to secure various door components should be removed as follows: drive out the center of the rivet with a drift punch then drill out the rivet with a 1/4 inch drill bit. Components should be reinstalled using a 1/4-20 x 1/2 screw (6030163) and nut (118613) or their equivalents torqued to 90 in. lbs.

Hinge Replacement

- (1) Support door with a padded floor jack.
- (2) Mark outline of hinge on door and body to aid in assembly.
- (3) Remove hinge to body screws.
- (4) Remove hinge to door screws and remove hinge.

- (5) Reverse above procedure for installation.

Door Adjustment

Door adjustments should be made by loosening one hinge at a time and moving door into position. Support door with a padded floor jack.

FORE AND AFT adjustments are made by loosening bolts, attaching hinge to body pillars, and moving door to desired position.

UP AND DOWN adjustments are made by loosening bolts, attaching hinge to door pillar, and moving door to desired position. Up and down adjustments require loosening of both upper and lower hinges.

IN AND OUT adjustments are made by loosening the bolts, attaching hinge to door, and moving door to desired position.

Front Door Trim Panel (Fig. 2)**Removal**

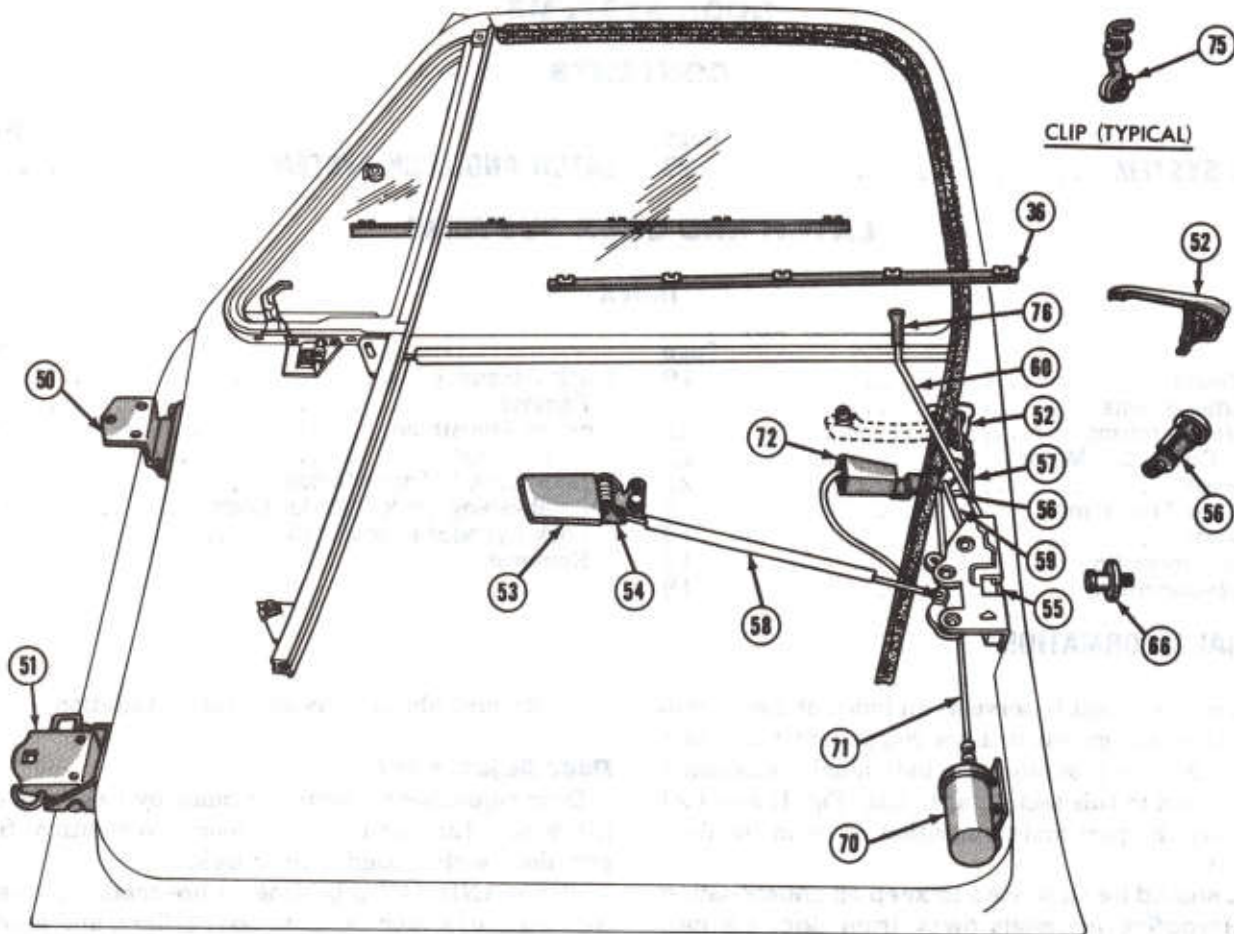
- (1) Remove remote control handle.
- (2) Remove window regulator handle.
- (3) Remove pull strap (if so equipped).
- (4) Remove screw at armrest—if required.
- (5) Using a trim stick or other suitable flat tool, gently pry trim panel away from door.
- (6) Reverse above procedure for installation.

LEGEND FOR FIGURE 1

50. Upper Hinge
51. Lower Hinge
52. Outside Door Handle
53. Inside Remote Handle
54. Remote Control
55. Door Latch
56. Door Lock Cylinder

57. Link, Outside Handle to Latch
58. Link, Remote Control to Latch
59. Link, Lock Cylinder to Latch
60. Link, Pushrod to Latch
61. Link, Pushrod to Latch Lock Control
62. Link, Latch Lock Control to Latch

63. Latch Lock Control
66. Door Latch Striker
70. Lock Solenoid
71. Link Solenoid to Latch
72. Locking Switch Assembly
75. Linkage Clips
76. Locking Knob



RY663

Fig. 1—Front Door Lock and Latch System

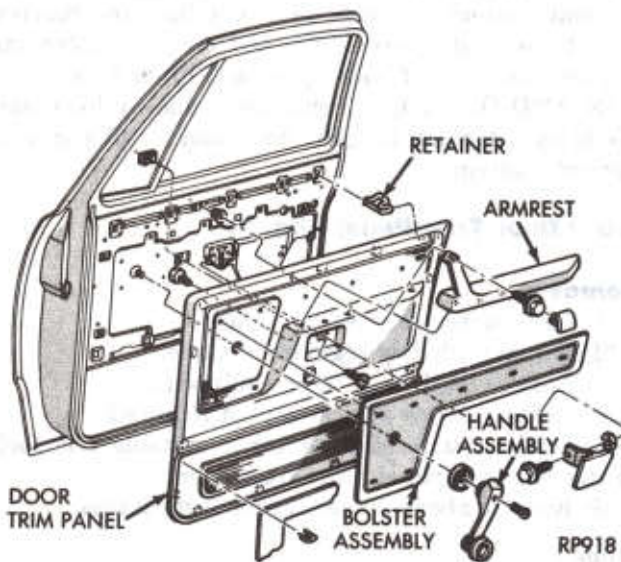


Fig. 2—Door Trim Panel

Outside Handle

Removal

- (1) Raise glass to full up position.
- (2) Remove door trim panel or access panel.
- (3) Disconnect handle link from latch assembly.
- (4) Remove fasteners securing handle to door and remove handle and link.
- (5) Reverse above procedure for installation.

Latch Assembly (Fig. 3)

Removal

- (1) Raise glass to full up position.
- (2) Remove door trim panel or access panel.
- (3) Disconnect all link attachments at latch.
- (4) Remove latch attaching screws and lift latch out through access holes.
- (5) Reverse above procedure for installation.

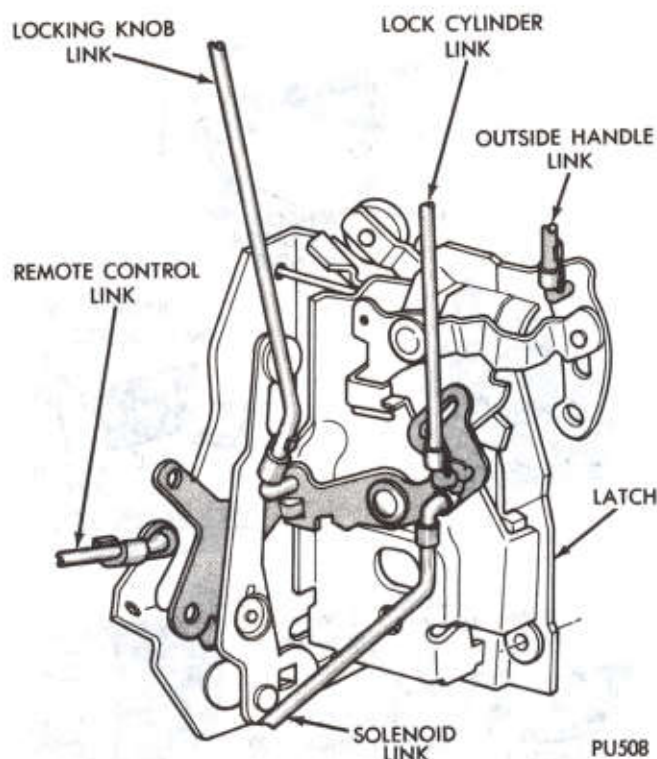


Fig. 3—Link Attachment to Latch

PU508

Linkage Adjustment

- (1) Locate the .312 (8mm) diameter access hole in the door face at the latch area.
- (2) Loosen door latch adjusting screw through the access hole.
- (3) Push up on the latch lever through the access hole to remove all slack from the linkage.
- (4) Tighten adjusting screw while holding latch lever in position.

LOCK CYLINDER (Fig. 4)

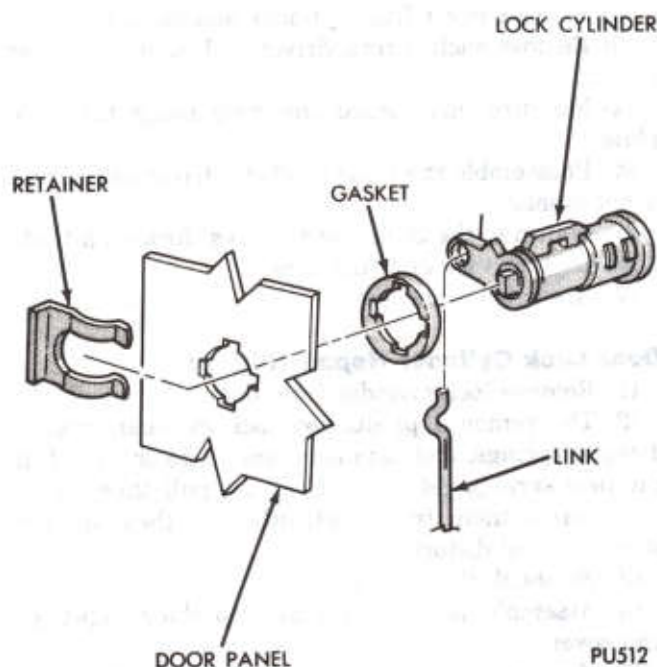
Removal

- (1) Raise glass to full up position.
- (2) Remove door trim panel.
- (3) Remove lock cylinder link from latch.
- (4) Remove lock cylinder retainer and remove lock cylinder and link from door.
- (5) Reverse above procedure for installation.

Lock Cylinder Procedures

The following procedures will allow the repair or replacement of lock cylinders while retaining the original key. It is no longer necessary to replace an entire set of lock cylinders when only one is defective.

Kits are available through MOPAR for repair of



PU512

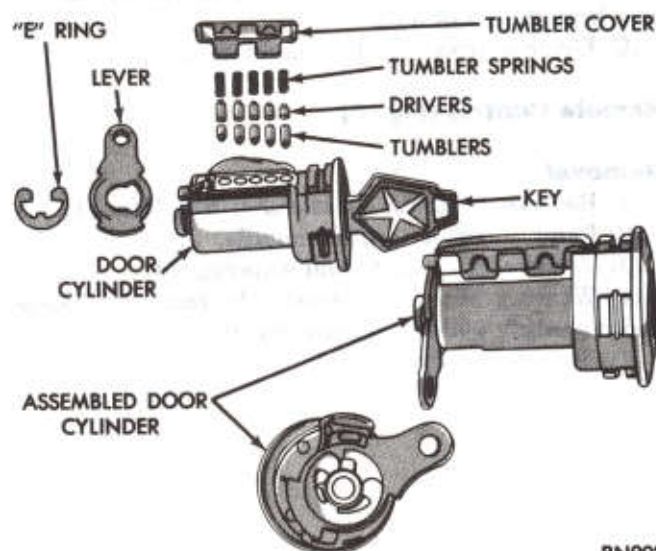
Fig. 4—Lock Cylinder

cylinders or an equivalent kit may be used. All necessary components are supplied in the kit for repairs, along with a key code book and instructions.

Establishing Lock Cylinder Code (Fig. 5)

When the key or code number is not available the following procedure should be used to establish the code number.

- (1) Remove door lock cylinder from vehicle.



RN902

Fig. 5—Door Lock Cylinder Components

- (2) Remove cover from cylinder and discard.
- (3) Remove each spring, driver and tumbler, one at a time.
- (4) Measure and record the code using the code plate.
- (5) Reassemble the same tumbler, driver and spring if not damaged.
- (6) Continue the coding procedures through all sets of springs, drivers and tumblers.
- (7) Assemble a new cover.

Door Lock Cylinder Repair (Fig. 5)

- (1) Remove lock cylinder from door.
 - (2) The removed production lock cylinder, covers, drivers, springs, and tumblers should be scrapped. If the new springs get tangled, do not pull them apart ... unscrew them from each other so they are not stretched and distorted.
 - (3) Establish the key code.
 - (4) Assemble new drivers and tumblers, springs, and cover.
- The lever and E-ring may be reused if not damaged.
- (5) Test assembled door lock cylinder for function and reinstall into door.

Electric Door Lock Motor

Removal

- (1) Raise glass to full up position.
- (2) Remove door trim panel or access panel.
- (3) Disconnect motor from wiring harness.
- (4) Disconnect motor link from motor.
- (5) Remove motor mounting screws and lift motor out through access hole.
- (6) Reverse procedure for installation.

Remote Control (Fig. 6)

Removal

- (1) Remove regulator handle shown in (Fig. 6).
- (2) Remove remote control handle.
- (3) Remove trim panel, and watershield.
- (4) Working through access hole remove linkage and mounting plate to remote control.
- (5) Remove remote control.

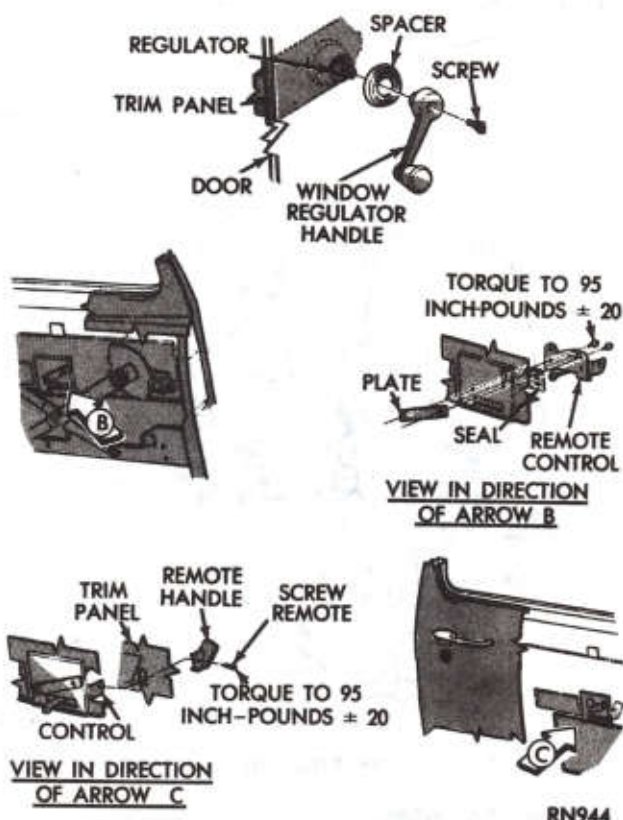


Fig. 6—Remote Control Assembly

Installation

- (1) Slide remote control mounting plate through access hole and into door.
- (2) Connect linkage and install screws to remote control assembly.
- (3) Install remote control handle and adjust forward to eliminate excess handle travel.
- (4) Install trim panel, remote and regulator handle.

Door Weatherstrip

The weatherstrip is cemented to the door opening by applying adhesive to the body and allowing it to dry until tacky. Apply adhesive to the weatherstrip and apply to body opening as shown. After installation, do not close door, allow adhesive to dry then check to see that the weatherstrip is making good sealing contact with the door.

GLASS SYSTEMS

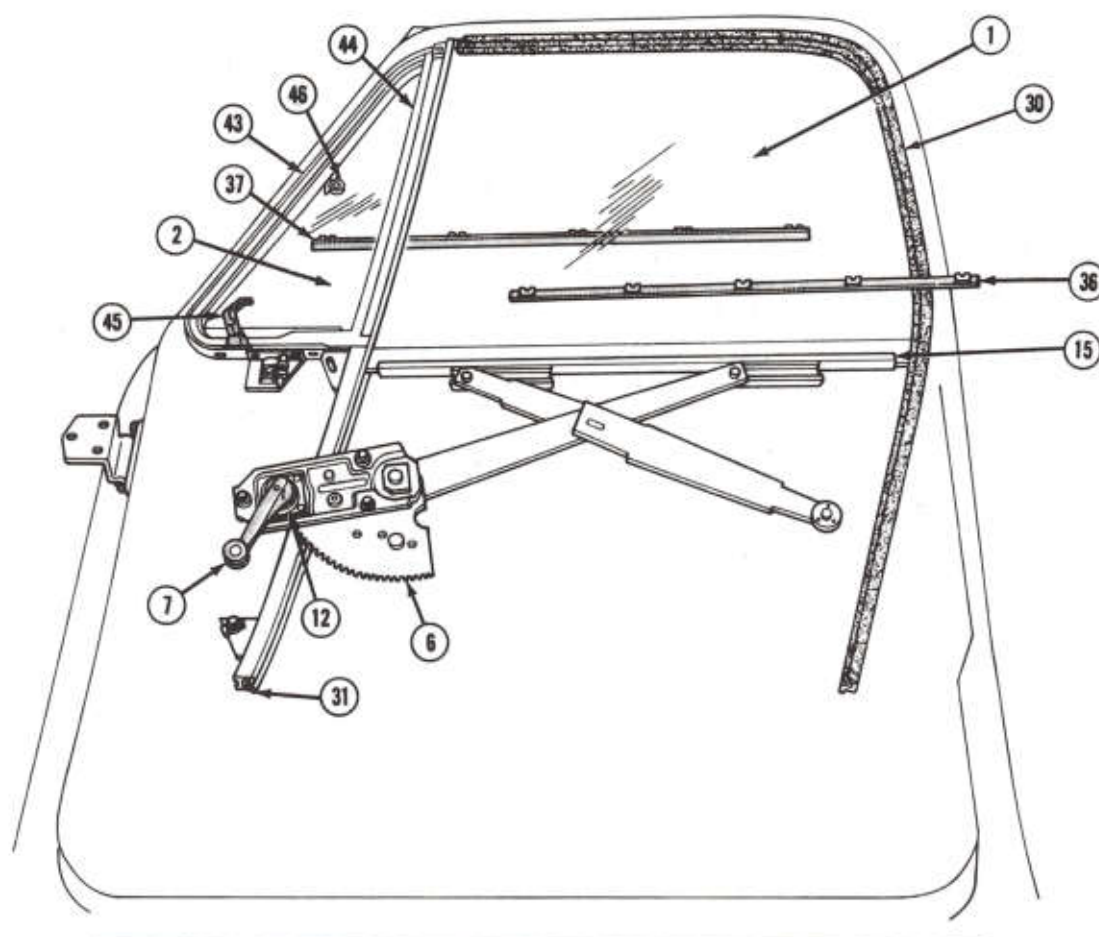
INDEX

	Page		Page
Front Door		Removal	25
Blind Rivets	24	Installation	25
Door Glass	24	Vent Wing Assembly	24
Removal	24	Removal	24
Installation	24	Installation	24
Electric Window Regulator	25	Vent Wing Glass	24
Removal	25	Removal	24
Installation	25	Installation	24
Manual Window Regulator	25		

GENERAL INFORMATION

Figure 1 is meant to serve as an index or component guide. It is meant to show component name and location. Service procedures on individual components can be found in this section also. Use (Fig. 1) as a tool to identify the part and its location on or in the door assembly.

Care should be exercised to keep all undercoating or rustproofing materials away from door components. A significant cause of door system malfunctions is contamination by rust prevention materials.



RY664

Fig. 1—Front Door Glass System

Blind Rivets

The 1/4 inch blind rivets used to secure various door components should be removed as follows: drive out the center of the rivet with a drift punch then drill out the rivet with a 1/4 inch drill bit. Components should be reinstalled using a 1/4-20 x 1/2 screw (6030163) and nut (118613) or their equivalent torqued to 90 in. lbs. (10 N·m).

Vent Wing and Glass Run Assembly (Fig. 2)

Removal

- (1) Lower glass and remove inner weatherstrip.
- (2) When removing inner belt weatherstrip use care not to scratch the beltline paint.
- (3) Free the clip on the inner section of the weatherstrip with a wire hook or suitable tool.
- (4) Pull back upper glass run 8 to 10 inches (20-25 Cm).
- (5) Remove upper and lower vent wing attaching screws.
- (6) Remove vent wing, taking care to avoid paint damage from glass lower pivot adjusting screws.

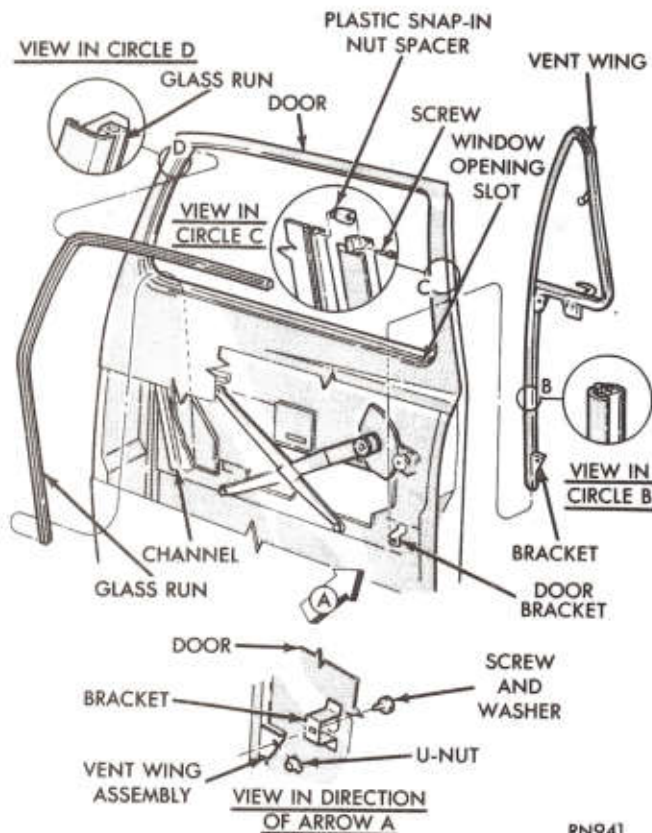


Fig. 2—Vent Wing and Glass Run

Installation

- (1) Install plastic nut and "U" nut on vent wing assembly.
- (2) Install vent wing assembly into door taking care not to damage paint with lower pivot adjusting screw.
- (3) Install upper and lower vent wing attachment screws.
- (4) Move glass run back to vent wing by placing run adjacent to door channel and press into channel using wide bladed screwdriver or similar tool. Press in both inside corners to insure hidden lip engages in channel.
- (5) Install belt weatherstrip by aligning clips to holes in door and press in.
- (6) Raise or lower vent to maintain a .06 (1.6mm) fore-aft glass freeplay then with glass up, tighten upper screws.
- (7) Hold vent against glass (glass down) and tighten lower screws.

Vent Wing Glass

Removal

- (1) Remove vent wing.
- (2) Remove screw from lower glass pivot.
- (3) Remove upper glass pivot fastener and remove glass and frame assembly.

Installation

- (1) Lubricate lower glass pivot with Spray White Lube or equivalent.
- (2) Install lower glass pivot into glass frame.
- (3) Install upper glass pivot.
- (4) Install vent wing.

Side Glass Replacement

Removal

- (1) Remove rear stationary glass.
- (2) Remove inner and outer weatherstrips.
- (3) Remove regulator arm from lower channel.
- (4) Remove glass from door.
- (5) Remove lower channel from glass.

Installation

Before installing glass, lubricate all moving parts of regulator with Spray White Lube or equivalent.

- (1) Install lower channel on glass.
- (2) Position glass into door opening.
- (3) Install regulator arm roller into channel of glass lift bracket.
- (4) Position glass into run channels and adjust glass.
- (5) Install rear stationary glass.
- (6) Install inner and outer weatherstrips.

Glass and Weatherstrip (Fig. 3)

To assemble window glass to door (Fig. 3) insert glass to everseal. Place channel assembly onto everseal. Press seal onto channel securely and lubricate channel. Lower regulator to down position. Place glass and channel assembly into slot opening in door and lower it to the bottom of door. Reach through the access hole in door and install regulator to lower channel on glass, and to upper channel. Install vent wing. Test glass for proper movement. Adjust vent up to eliminate fore and aft freeplay. Then install the weatherstrip assembly front and rear to door.

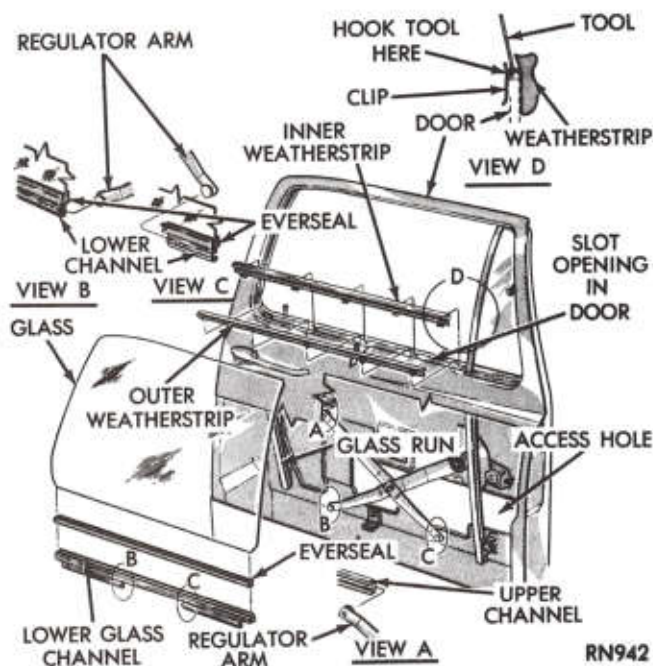


Fig. 3—Glass and Weatherstrip

Manual Window Regulator (Fig. 4)

Removal

- (1) Lower window to full down position.
- (2) Remove trim panel and watershield.
- (3) On stereo equipped vehicles remove lower trim panel and remove speaker.
- (4) Remove vent wing.
- (5) Slide glass forward off of regulator arms and lower glass to door bottom.
- (6) Drill out regulator mounting rivets and remove regulator through access hole.

Installation

- (1) Insert upper regulator arm into door mounted channel.
- (2) Mount regulator to door panel with 1/4-20 screws and nuts torqued to 90 in. lbs. (10 N·m).
- (3) Slide glass onto regulator arms and into rear glass run.

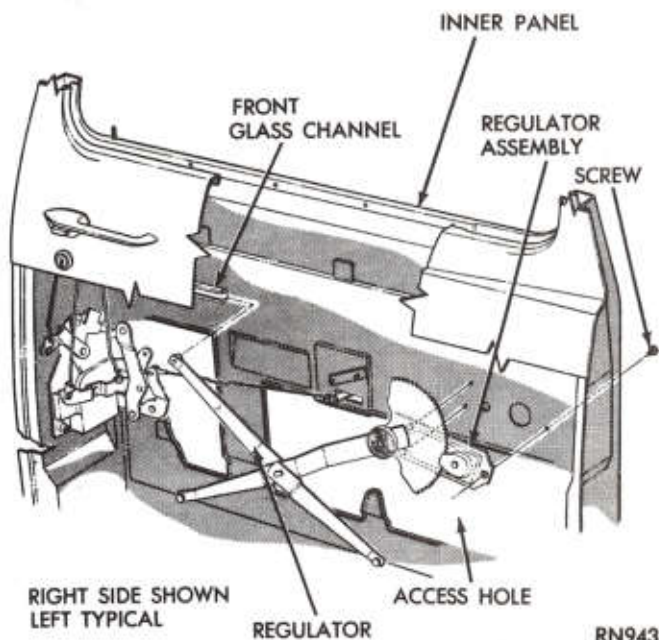


Fig. 4—Window Regulator

- (4) Install and adjust vent wing.
- (5) Raise glass to full up position.
- (6) Install stereo speaker (if so equipped).
- (7) Install trim panel and watershield.

Electric Window Regulator

Removal

- (1) Remove trim panel and watershield.
- (2) Remove lower trim panel on stereo equipped vehicles.
- (3) Remove down stop bumper bracket.
- (4) Remove stereo speaker (if so equipped).
- (5) Remove vent wing.
- (6) Connect switch and lower glass to full down position.
- (7) Disengage glass from regulator arms and lower to door bottom.
- (8) Drill out regulator mounting rivets and remove regulator through large access hole.

Installation

- (1) Insert upper regulator arm into door mounted channel.
- (2) Mount regulator to door panel with 1/4-20 screws and nuts torqued to 90 in. lbs. (10 N·m).
- (3) Slide glass onto regulator arms and into rear glass run.
- (4) Install and adjust vent wing.
- (5) Raise glass to full up position.
- (6) Install stereo speaker (if so equipped).
- (7) Install down stop bumper bracket.
- (8) Install trim panel and watershield.

FIXED GLASS

INDEX

	Page		Page
Liftgate Glass and Weatherstrip	28	Removal	27
Removal	28	Installation	27
Installation	28	Latch and Catch	28
Rear Roof Vent	31	Sunroof	30
Rear Window	27	Windshield	26
Rear Window (Sliding Glass Type)	27	Removal	26
Quarter Panel Glass (Fixed)	29	Installation	26
Sliding Glass Section	27		

Model Identification

AD = Ramcharger Two-Wheel Drive
 AW = Ramcharger Four-Wheel Drive
 D = Light Duty Truck Two-Wheel Drive
 W = Light Duty Truck Four-Wheel Drive

Windshield (Fig. 1)**Removal (Fig. 2)**

- (1) Cover cowl panel to protect paint finish.
- (2) Remove wiper arms and blades, Refer to Wiper Section in this service manual.
- (3) Remove the retainer cap. Pry out one end of retainer and carefully pull retainer from around weatherstrip.
- (4) With an assistant supporting the windshield on

the outside, from inside cab, push one corner of glass out of weatherstrip. Progressively force entire glass out of weatherstrip.

(5) Remove glass from opening.

(6) The weatherstrip will remain in place on windshield opening if so desired.

Installation (Fig. 3)

Mineral spirits **only** should be used as a lubricant to aid installation.

(1) Install weatherstrip (if removed) on windshield opening fence carefully, making sure weatherstrip is properly seated.

(2) With an assistant's aid, slide one corner of glass into lower glass groove of weatherstrip.

(3) Move glass into groove as far as possible and

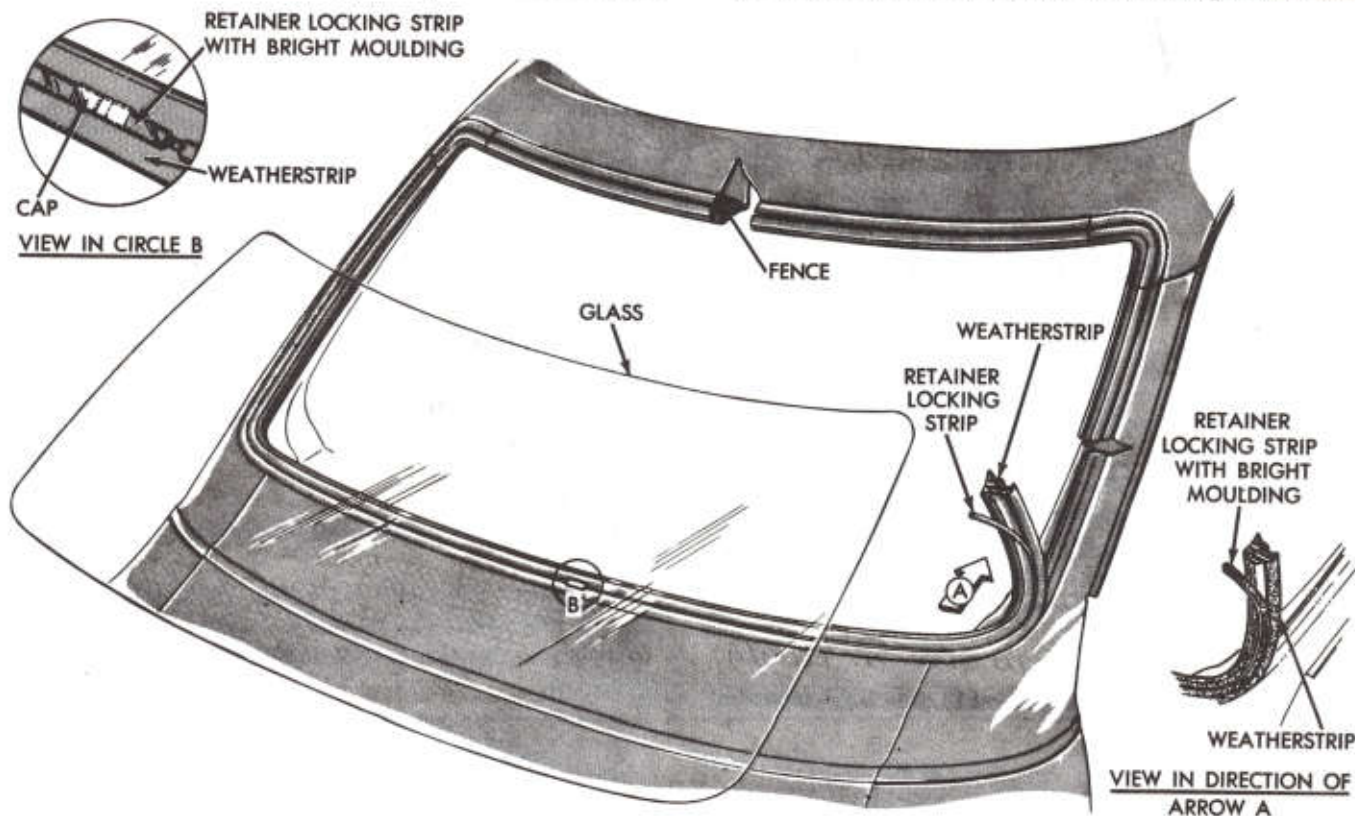


Fig. 1—Windshield Assembly

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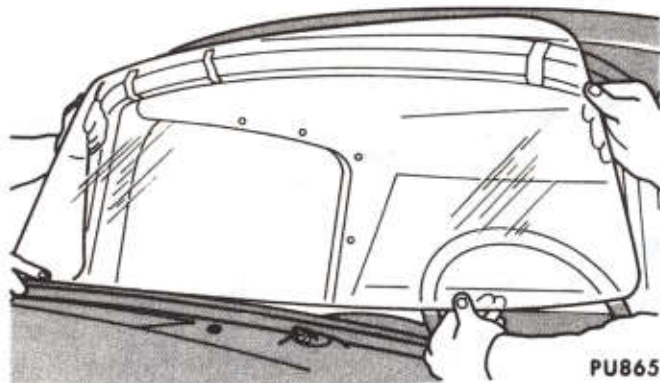


Fig. 2—Windshield Removal (Typical)

using a fiber wedge force lip of weatherstrip over glass around its entire circumference.

(4) Start at one of lower corners of windshield and insert retainer in groove. Care should be taken not to overstretch locking strip when installing in weatherstrip. Install locking strip cap.

(5) Water test windshield area and inspect for leaks.

(6) Install windshield wiper arms and blades.

Rear Window

Replacement (Figs. 4, 5, 6)

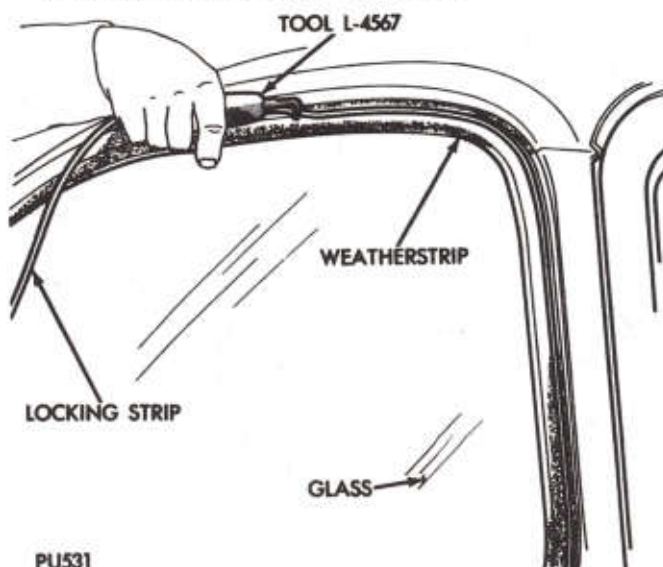
Removal

(1) Pry out one end of mylar retainer if applicable and carefully pull retainer from around weatherstrip.

(2) From inside the cab, push one corner of glass out of weatherstrip. Progressively force entire glass from weatherstrip.

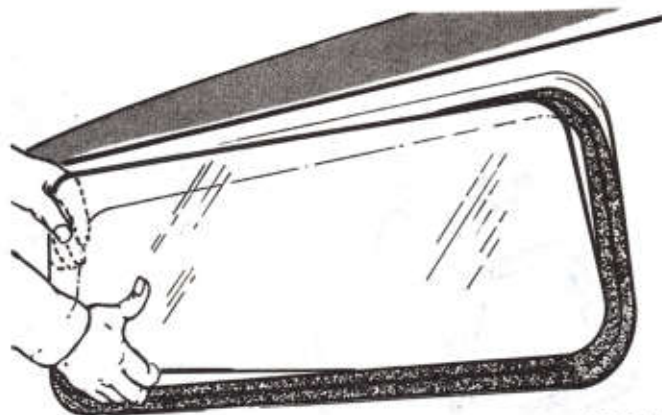
Installation

(1) Assemble weatherstrip to glass.



PU531

Fig. 3—Windshield Installation



PU866

Fig. 4—Rear Window Removal

(2) Insert mylar locking strip to weatherstrip (if applicable).

(3) Install cord in weatherstrip retainer.

(4) Place the assembly to the glass opening.

(5) Install the assembly using the installation cord.

Rear Window (Sliding Glass Type Fig. 6)

The procedure for service on the sliding glass window assembly is similar to the windshield.

To service the sliding glass sections follow that procedure.

Sliding Glass Section

Removal

(1) Remove the complete rear window assembly.

(2) Place assembly in a clean padded area.

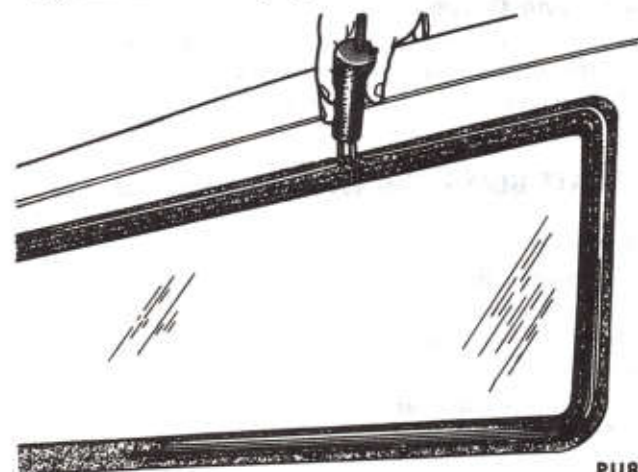
(3) Loosen screws located on the bottom of the frame.

(4) Carefully spread frame apart.

(5) Remove sliding glass section from assembly.

Installation

(1) Install sliding glass section into track in



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Fig. 5—Rear Window Installation

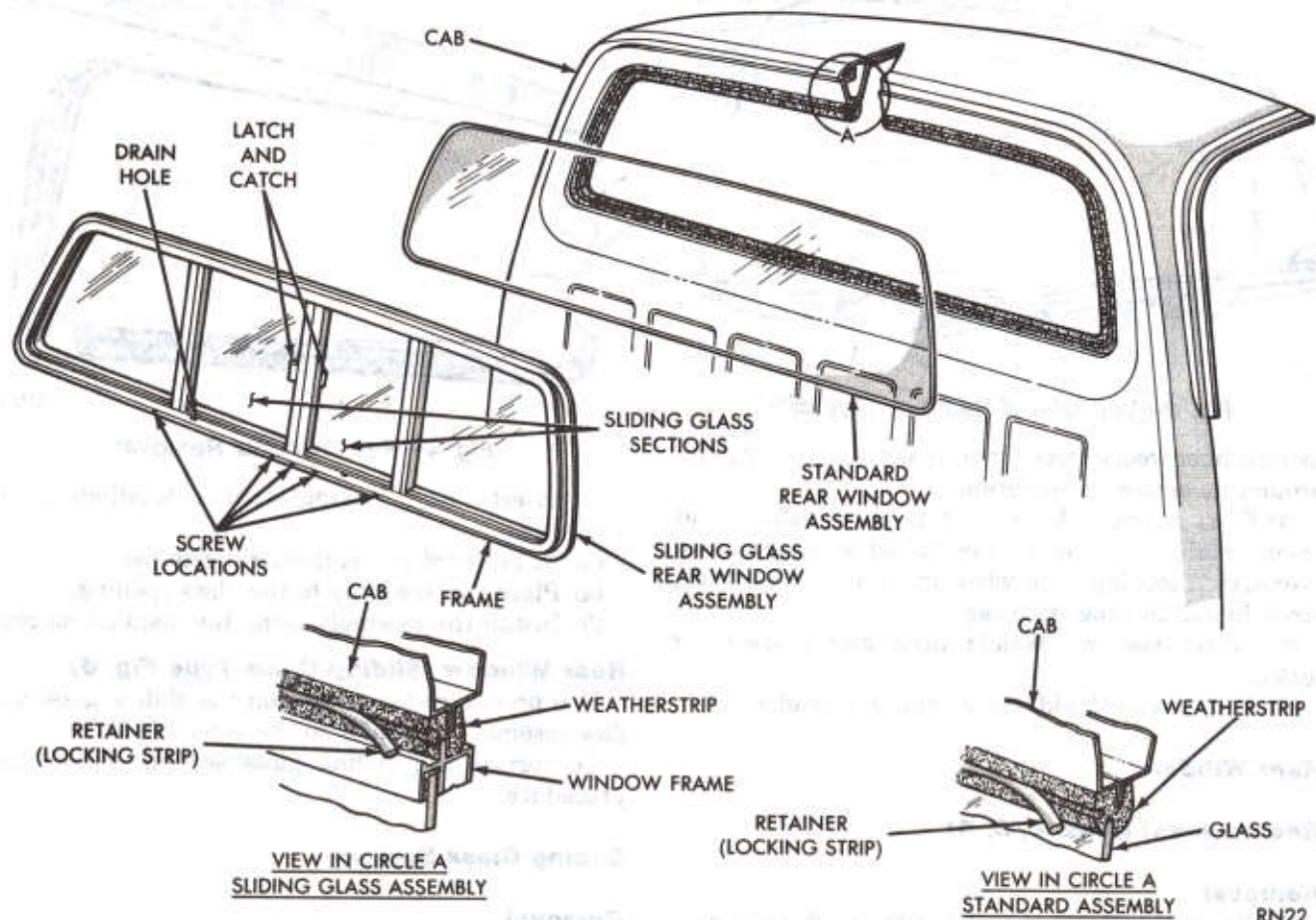


Fig. 6—Rear Window (Sliding Glass Type)

assembly.

- (2) Tighten all screws on frame assembly.
- (3) Check correct travel and latching of sliding sections.
- (4) Install rear window assembly to vehicle.
- (5) Check to see that drain holes are clear.

Latch and Catch

The latch and catch are located on the sliding glass sections on the inside of cab with screws.

To service the latch or catch remove or replace screws.

LIFTGATE GLASS AND WEATHERSTRIP AD, AW

Removal

- (1) Insert fiber stick between glass weatherstrip retainer and panel.
- (2) With an assistant gently force glass and weatherstrip retainer away from frame.
- (3) Remove glass and weatherstrip retainer assembly from liftgate.

Installation

- (1) Install cord in weatherstrip retainer (Fig. 7).

- (2) Install glass and weatherstrip assembly to liftgate opening.
- (3) Install the assembly to the door frame by using an installation cord.
- (4) Clean glass.

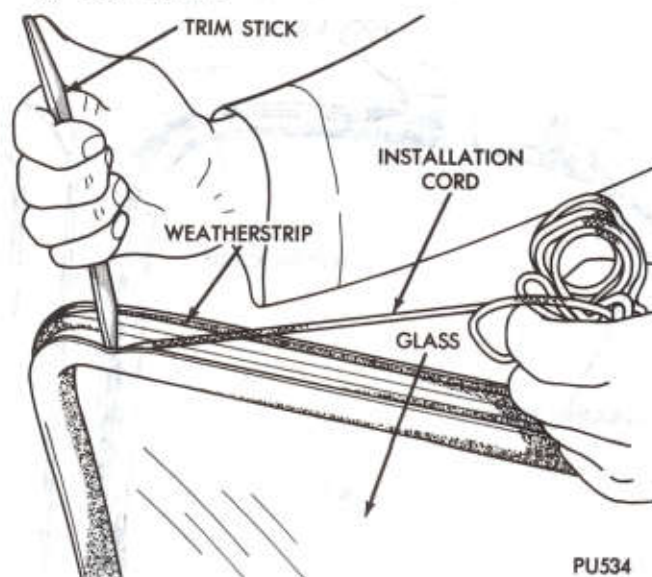


Fig. 7—Installation Cord

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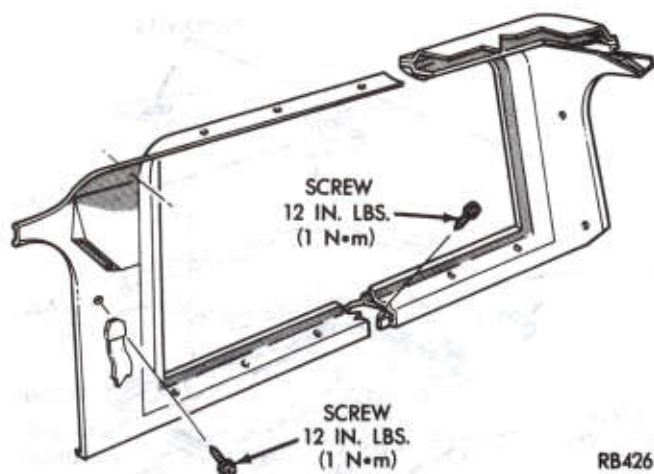


Fig. 8—Quarter Window Garnish Moulding

Quarter Panel Glass (Fixed) AD, AW

Removal

- (1) Remove interior quarter glass trim (Fig. 8).
- (2) Remove exterior mouldings (Fig. 9).
- (3) With an electric knife (Miller tool 4386 or equivalent) cut existing butyl tape as close as possible to fence flange.

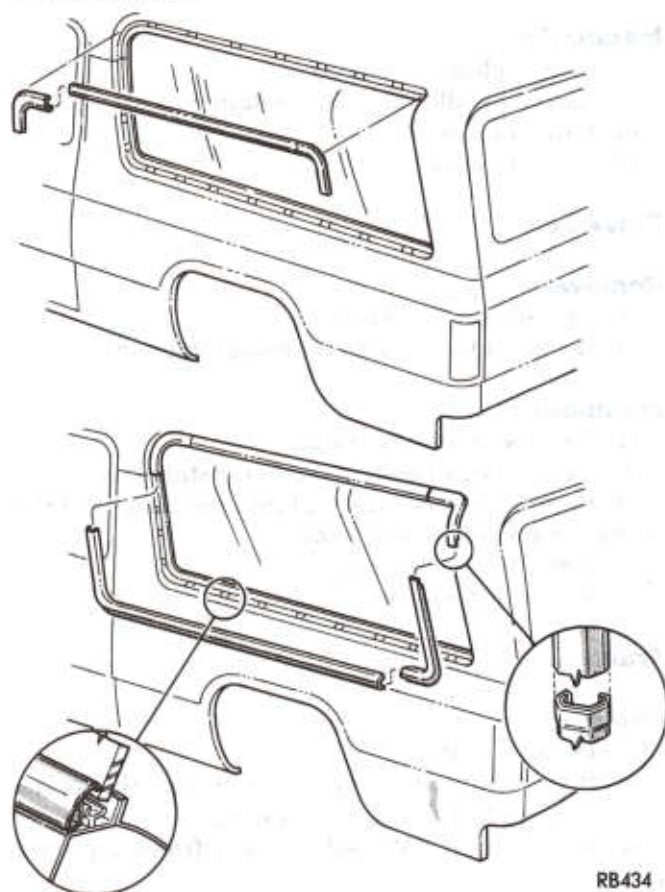


Fig. 9—Quarter Window Mouldings

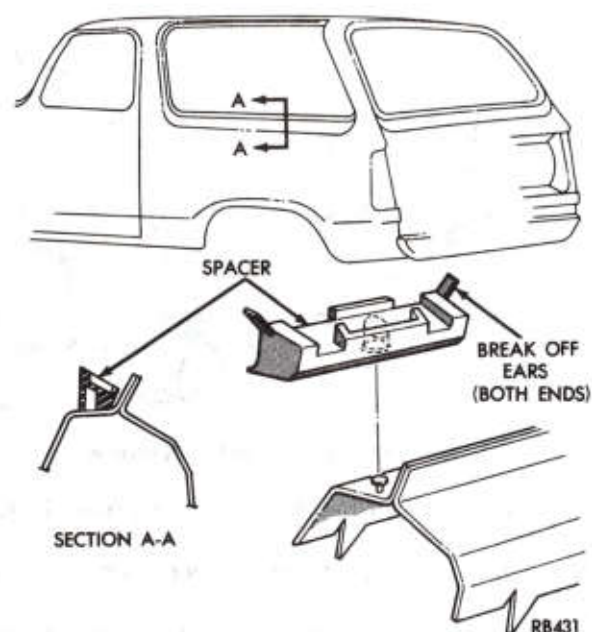


Fig. 10—Installing Quarter Window Spacers

- (4) Remove the glass from opening by applying an even pressure to the glass.

Installation

- (1) Remove remaining butyl tape on body opening surface as close as possible to the metal surface. If original glass is to be installed, remove all butyl tape from glass surface.
- (2) Apply primer to glass and allow 10 minutes for primer to dry. Avoid contact with primed surface.

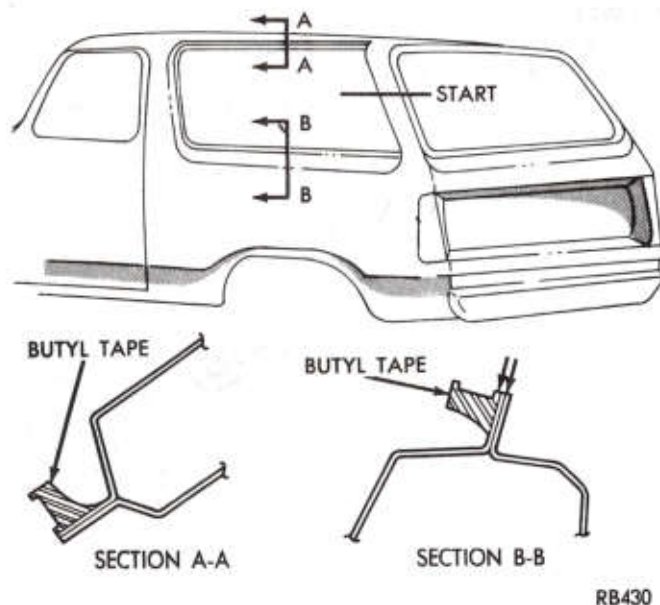


Fig. 11—Installing Butyl Tape

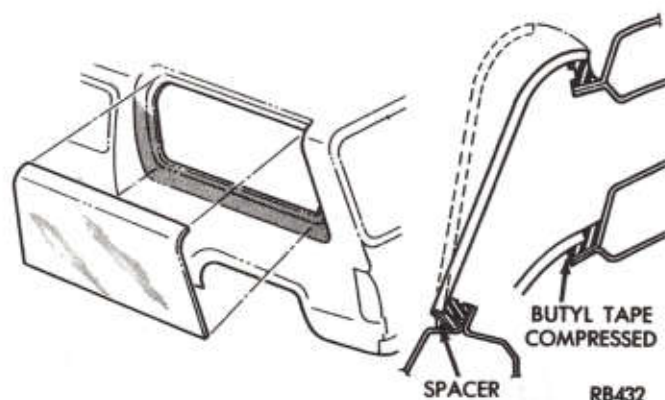


Fig. 12—Installing Quarter Window

- (3) Check quarter window spacers for proper installation (Fig. 10).
- (4) Apply butyl tape to entire periphery of fence (Fig. 11).
- (5) Cut excess tape away and butt the ends firmly together.
- (6) Install quarter glass to butyl seal (Fig. 12).
- (7) Compress glass to seal to achieve a good seal.
- (8) Test quarter glass for water leaks.
- (9) If leakage occurs, additional sealing may be required. Use a suitable windshield sealer (Fig. 13).
- (10) Install mouldings.
- (11) Clean glass.

SUNROOF (Fig. 14)

Glass

Removal

- (1) Unlatch front bayonet mounts.
- (2) Unlatch rear handle.
- (3) Unlatch catch retainer by pushing slide bar and

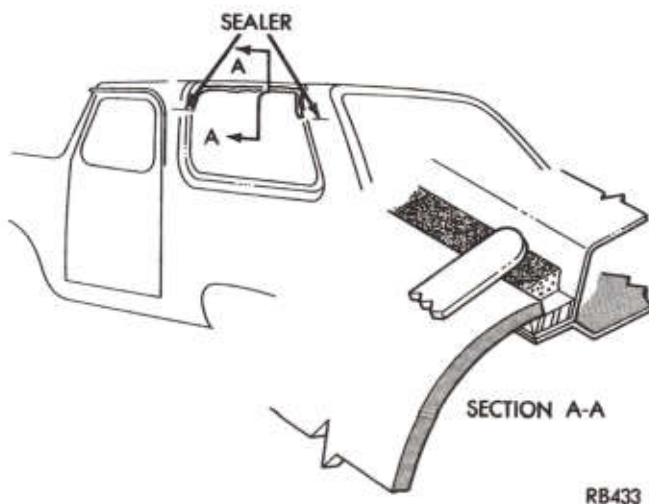


Fig. 13—Sealing Quarter Window

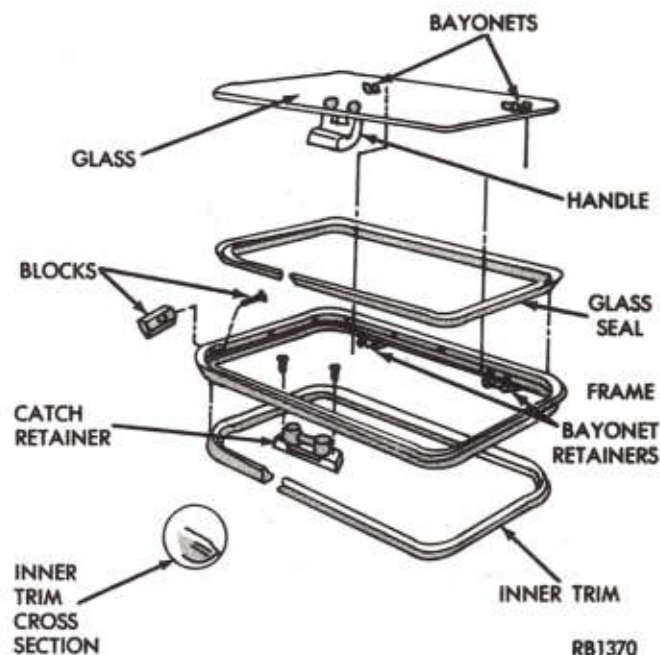


Fig. 14—Sunroof AD, AW, D, W

remove handle from retainer.

- (4) Lift glass from opening.

Installation

- (1) Center glass in opening.
- (2) Install handle into catch retainer.
- (3) Latch handle.
- (4) Latch bayonets.

Glass Seal

Removal

- (1) Remove sunroof glass.
- (2) Remove glass seal from frame (glued in).

Installation

- (1) Clean seal area of frame.
- (2) Using a weatherstrip cement install seal.
- (3) Be sure to crowd the seal into the corners of the frame for proper glass sealing.
- (4) Install sunroof glass.
- (5) Water test sunroof.

Frame

Removal

- (1) Remove sunroof glass.
- (2) Remove inner trim by pulling it from the frame.
- (3) Remove blocks which retain frame to roof.
- (4) Break the R.T.V. seal between frame and roof panel.
- (5) Remove frame.

Installation

- (1) Clean frame and roof sealing surfaces.
- (2) Apply a bead of R.T.V. sealer P/N 4318025 to the frame sealing surface.
- (3) Install frame to roof.
- (4) Install blocks to frame and evenly tighten in a cross pattern. **Do not overtighten.**
- (5) Clean any R.T.V. which is showing.
- (6) Install glass to frame.
- (7) Allow R.T.V. to set and water test.
- (8) Install inner trim.

Handle

Removal

- (1) Remove sunroof glass.
- (2) Remove bolts which hold handle to glass.

Installation

- (1) Attach handle to glass with bolts.
- (2) Install glass to frame.
- (3) Water test for leakage at bolts.

Bayonets

Removal

- (1) Remove sunroof glass.
- (2) Remove bolt which holds bayonet to glass.

Installation

- (1) Attach bayonet to glass with bolt.
- (2) Install glass to frame.
- (3) Water test for leakage at bolt.

ROOF VENT (Fig. 15)

Vent Cover

Removal

- (1) Open cover.
- (2) Drill upper rivet head from cover/handle.
- (3) Remove vent cover hinge.
- (4) Remove cover.

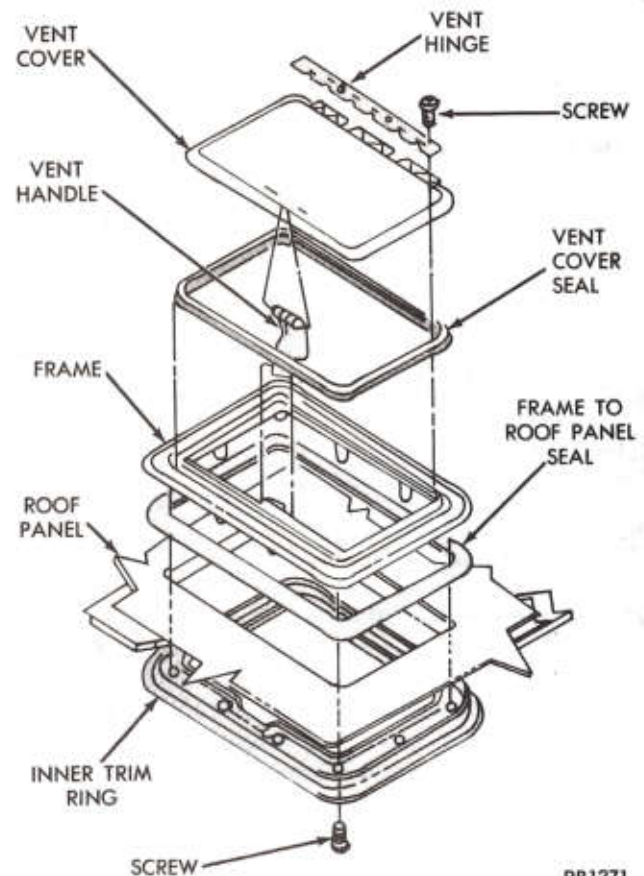
Installation

- (1) Install cover.
- (2) Attach hinge.
- (3) Install handle to cover using a 2.125 x .187 inch rivet or equivalent.

Vent Cover Seal

Removal

- (1) Open cover.
- (2) Remove cover hinge.
- (3) Remove cover seal from frame.



RB1371

Fig. 15—Roof Vent AD, AW

Installation

- (1) Clean seal area of frame.
- (2) Using a weatherstrip cement install seal.
- (3) Install cover hinge.
- (4) Water test vent.

Frame

Removal

- (1) Remove inner trim ring.
- (2) Break the seal between frame and roof panel.
- (3) Remove frame/cover assembly.

Installation

- (1) Clean frame and roof sealing surfaces.
- (2) Install seal to frame.
- (3) Install frame to roof.
- (4) Install inner trim ring and tighten.
- (5) Water test frame area.

Note: R.T.V. Silicone Sealer may be used for additional sealing.

Handle

Removal

- (1) Open vent cover.

- (2) Drill rivet head from handle to cover.
- (3) Drill rivet head from handle to frame.
- (4) Remove handle.

Installation

- (1) Place handle in position.

- (2) Install handle to cover using a 2.125 x .187 inch rivet or equivalent.
- (3) Install handle to frame using a 1 x .140 inch rivet or equivalent.

REFINISHING PROCEDURES

INDEX

	Page		Page
Base Coat/Clear Coat Finish	32	Flexible Panel Refinishing	34
Buffing and Polishing	33	Paint Bake Oven Treatment (Textured Grilles) ...	36
Color Application	34	Paint Charts	37
Color Coating Procedure	34	Painting Plastic Components	35
Color Sanding, Buffing, and Polishing	33	Paint Repairs (Galvanized Metals)	33
Corporate Identity Codes and Color Charts	37	Preparing Surface for Paint	34
Definitions (Technical Terms)	32	Rust Protection	33
Fiberglass Finishes	36	Safety Measures	36

Base Coat/Clear Finish

Vehicles today are sprayed in a hospital clean environment to eliminate dirt and foreign substances. The paint used is a two part application. The base coat which is applied on top of a special eight stage primer, gives the vehicle its color. After the color (base coat) is applied, a special spray gun, called a turbo-bell, sprays the clear coat (topcoat) on the vehicle. This clear coat gives the paint finish its high gloss and durability.

To determine correct color and part number of enamel used on the car, refer to code on body number plate and then locate corresponding code on paint chart. Proper safety equipment should be used and work should be done in a well ventilated area.

DEFINITIONS OF TECHNICAL TERMS

Single Coat

A single coat is a spray pattern applied from left to right. The returning right to left pattern is applied so that it covers approximately half of the preceeding pattern. This process is repeated until coverage of the panel is complete.

Double Coat

A double coat is a spray pattern applied from left to right then back again over the same area. A panel is

covered by overlapping each double coat by at least 50%.

Drying

Drying or hardening of a film goes through several stages. **First** is known as "dust free" and is the time required for a film to reach the condition where, if any dust settles on it, dust will not become imbedded, but may be wiped off after film has hardened. **Second** stage is known as "tack free" and is the time required for a film to reach the condition where it may be touched with light pressure of finger. **Third** is "hard dry" and is the time required for film to become thoroughly hard so that it may be rubbed and polished.

Degrease—Dewax

This is wiping with a clean cloth saturated with a commercial cleaner. Essential to good paint adhesion.

Featheredging

This is tapering of edges of a finish so that when a finger is passed over it no break will be felt. Featheredging is usually done with water and sandpaper on a sand block. This term applies to the sanding of a defect to the prime or color coat.

Ferrous and Non-Ferrous Metals

Ferrous metals are those which are made from iron (steel). Non-ferrous metals are those which are not made from iron or do not present an iron (steel) surface, such as aluminum, aluminum alloys, brass, copper, and magnesium.

Flash Time

This is the time required for an applied coat of paint to lose most of its solvent.

Mist Coat

This is over thinning the color and spraying wet. Usually the final coat.

Priming

The function of a primer is to act as a surfacer for the finished color coat. It also forms a bond between the metal surface and the color coat.

A glazing putty is used for filling in small imperfections which are too deep to be taken care of by surfacer coats. It may be applied either before or after the last coat of primer surfacer.

Reducers

Reducers are mixtures of volatile liquids used to reduce alkyd and synthetic primers and enamels to the proper consistency for application.

Sanding Block

As a rule a sanding block is a flexible rubber block, to which sandpaper may be fastened. It offers a good grip for the operator.

Wherever possible sanding should be done with a block as it distributes the pressures and gives a more uniform surface.

Surfacing

The function of a surfacer is to prepare a smooth surface for the color coats.

Tack Rag

This is a piece of cheesecloth that has been dipped in thin, non-drying varnish and then wrung out. It is kept in a container so that varnish will not harden but will remain tacky. Tack rag is used to wipe off a surface to remove dust and lint.

Thinners

Thinners are mixtures of volatile liquids used to thin lacquer type finishing materials to proper consistency for application.

Undercoats

All products used to prepare the surface to receive color coats are classified as undercoats, such as primers, surfacers, putties, primer surfacers and sealers.

PAINT REPAIRS ON GALVANIZED METALS

To perform paint repairs on galvanized rocker panels or any other galvanized steel surfaces, care must be exercised when preparing bare galvanized surface to properly accept primer surfacer and finish paint. Do not use shortcut methods nor intermixing of materials.

Metal Preparation

(1) Wire brush or steel wool entire metal surface and remove all grease or oil, with wax and grease remover.

(2) Thoroughly sand affected area to remove all corrosion products from exposed metal surface while carefully feathering all paint edges.

(3) Treat bare metal panel with a conditioner according to label directions.

(4) Rinse with clean water and blow off with compressed air.

Refinishing

(1) Apply one light coat of primer for adhesion.

(2) Apply primer surfacer if required.

(3) Sand when dry and proceed with application of finish coats according to paint manufacturers recommendations.

RUST PROTECTION

Prior to applying any paint to the sheet metal clean the area to be repainted.

Eliminate all fingerprints, chemically treat all bare metal.

This conditions the exposed metal to resist rust.

BUFFING AND POLISHING

Minor imperfections in paint finish normally can be removed by sanding, buffing and polishing. The following procedure should be used when working on these minor conditions:

(1) Wet sand by hand affected area using #600 paper which has been soaked in mineral spirits. Caution should be used not to rub too hard over any of the affected areas or on ridges.

(2) Remove sand sludge.

(3) Tack off area with a clean, soft cloth.

(4) Buff entire area using a fine buffing compound.

COLOR SANDING, BUFFING, AND POLISHING

(1) Wrap a piece of 600 grit or finer wet or dry sandpaper around a two inch by three inch (2 x 3) rubber squeegee.

(2) Apply a few drops of mineral oil or water over and around the paint condition. (Baby oil can be substituted for mineral oil).

(3) Sand the paint condition in a light circular motion in order to just sand the top of the orange peel. Use rubber squeegee to check the sanding operation after three or four passes, making certain not to over sand.

(4) Use a buffing machine with a cutting pad and very fine compound to buff out the sanding marks.

(5) Either by hand or machine, remove wheel marks with a cleaner and polisher and detail work area until clean.

COLOR COATING PROCEDURE FOR PAINTING SECTIONS OF A PANEL—USING ACRYLIC ENAMEL

(1) Dewax and degrease complete panel by using correct solvents. Follow instructions and procedures printed on label of product being used.

(2) Sand the area to be repaired to within 1/16 or 1/8 of an inch of breakline or breaklines. 360 or 400 grit wet sanding paper can be used or 280 or 320 grit dry sanding paper can be used.

(3) Use blow gun with approximately 30 pounds air pressure and a good tack rag to remove dust and dirt from complete work area and adjacent panels.

(4) Apply 3/4 inch masking tape to the breakline or breaklines and allow approximately 3/16 of an inch of the tape to "overlap" the breakline or breaklines, then use the finger to fluff upward this 3/16 of an inch portion tape. Complete the masking operation with paper and tape to cover adjacent panels.

(5) Mix the color well on a paint shaker and cut the color with the correct solvents in a container which has marked measurements so as to follow the manufacturers instructions on how their materials should be used.

(6) Adjust air pressure at the air regulator only—not by air restrictor or kinking the 5/16 I.D. hose which should have large I.D. fittings.

(7) Apply the color with a good spraying technique, not twisting the wrist, until coverage and match is accomplished.

(8) Remove the masking when cured or dry and clean up or detail as necessary.

PREPARING THE SURFACE FOR PAINT

This operation is the backbone or foundation for finish color. It primes metal to insure adhesion and fills minor surface imperfections.

(1) Degrease and dewax the metal.

(2) Apply self-etching primer.

(3) To build substrate back to original thickness use a high blend primer.

(4) Sand undercoats (refer to paint manufacturer for recommended sandpaper grit).

(5) Respray with primer surface until the undercoat meets its original thickness.

(6) Resand undercoat with manufacturers recommended sandpaper.

(7) Reclean surface.

(8) Remove overspray from exterior and apply sealer recommended.

(9) Tack rag entire surface to remove lint and dust.

(10) Mix base coat.

(11) Apply base coat with light single coats. Allow for proper flash-off. Note: Apply sufficient amount of base coat to achieve coverage. If coverage is difficult to determine, tape on an opacity card on masking paper next to the surface to be painted.

(12) Allow proper dry time for base coat. Note: Do not use tack rag to remove dirt from base coat. This will only disturb the unprotected metallic flake and increases the dirt problem.

(13) Mix the clear coat according to manufacturers recommendations.

(14) Apply clear coat with light single coats. Allow for proper flash-off.

(15) Apply sufficient amount of clear coat to duplicate O.E.M. finish.

(16) Clean spraying equipment and detail car for customer pick-up.

COLOR APPLICATION

The most important step in color coat application is to follow the manufacturers instructions for the product being used. Similar products from different manufacturers will generally require different methods of application. Specific instructions on line pressure, coverage, thinning, etc. are usually available from paint supply manufacturers.

Metallic Color and Pearl Coats

Metallic color can appear to vary in richness. Variation can be described as:

A closed pattern that appears lighter with fine metallic dispersion.

An open pattern that appears richer with metallic flakes less noticeable.

An open pattern is achieved by lowering air pressure to 20-30 lbs. at gun, reducing acrylic lacquer color 100% with a blend of acrylic lacquer thinner and all purpose retarder.

FLEXIBLE PANEL REFINISHING

(1) Clean all surfaces with a wax and grease remover such as DX-330 ACRYLI-CLEAN or equivalent.

(2) Sand surface with #400 sandpaper and reclean surface as per step 1.

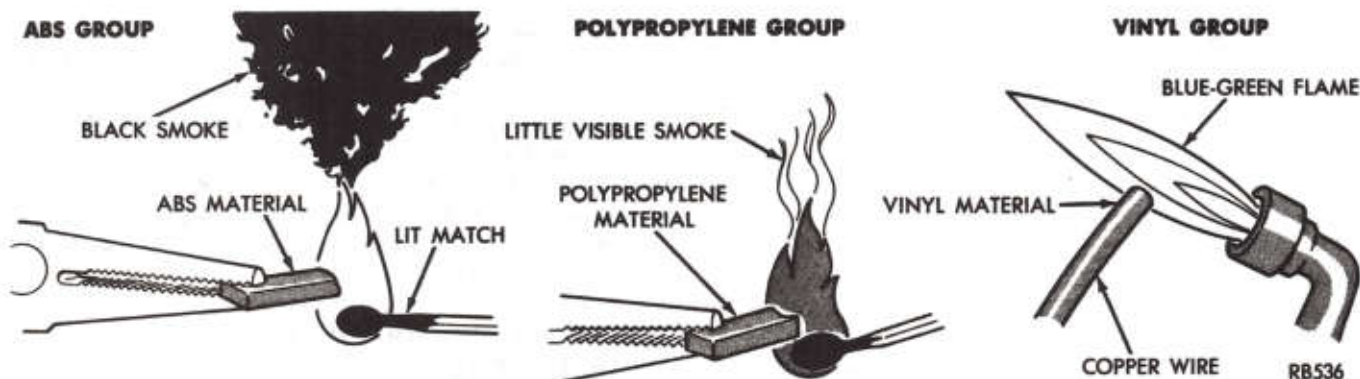


Fig. 1—Flame Test to Identify Plastic Materials

- (3) Apply one full wet coat.
- (4) Allow 10 to 15 minutes flash time.
- (5) Apply a final full wet coat.
- (6) Allow to dry 2 to 3 hours.

Flexible Panel Repair

It may not be necessary to replace a damaged flexible panel. Flexible panels are repairable using a product such as 3M 8101 Structural Adhesive or equivalent. For best results follow manufacturers instructions.

PAINTING PLASTIC COMPONENTS

To paint plastic trim components it is necessary to:

- (1) Identify the type of plastic to be painted.
- (2) Follow procedures recommended for the different types of plastics.

To determine which plastic is being used, cut a small sliver of plastic from the backside of the part to be painted. Hold the sliver in needle nose pliers and burn the plastic (Fig. 1).

(1) The ABS (Acrylo-nitrile/butadiene/styrene) group will burn with a heavy black smoke.

(2) The polypropylene group burns with no readily visible smoke.

(3) Nylon can be identified by the distinct odor of burning wool during the burn, rather than by the color or intensity of the smoke.

(4) The vinyl group will burn with a blue green tint.

To test for vinyl, heat a piece of copper wire red hot. Immediately apply the wire end to a nonvisible portion of plastic until a glob of plastic adheres to the wire. Place the glob into a flame and observe the color.

The following chart shows the types of plastics commonly used on trim components, and the procedure to follow.

Plastic Type	Examples	Painting Procedures
Rigid Vinyl	Bumper Filler	Flex Agent Required
RIM Urethane (Reaction Injection Moulding)	Fascias	Flex Agent Required
TPU (Thermoplastic Urethane)	End Caps Soft (Same as RIM)	Flex Agent Required
TPO (Thermoplastic Olefin)	Bumper Fillers	Flex Agent Required
FRP (Fiberglass Reinforced Polyester)	Nose Cones (Hard)	Same as Steel
Phenolic	Ash Trays	Same as Steel
Nylon	Spoilers, Louvers	Same as Steel
ABS (Acrylo-nitrile/Butadiene/Styrene)	Louvers	No Flex Agent
Polypropylene	Hard Seat Back, Garnish Moulding Dash	No Flex Agent

Rigid ABS

Rigid ABS requires no primer. The appropriate paint will adhere satisfactorily to this plastic.

- (1) Wash part thoroughly with a cleaning solvent such as DuPont Prep Sol, or equivalent.
- (2) Color coat the part, using the appropriate color.
- (3) Allow to dry. Install part.

Soft Exterior Plastics (Fillers, Fascias, Etc.)

Paints to be used on soft exterior parts require additives to allow the paint to flex without cracking.

- (1) Wash part thoroughly with a cleaning solvent such as DuPont Prep Sol, or equivalent.

(2) Sand the surface with 400 grit or finer paper. Reclean surface.

(3) Use the following Ditzler Flexative Agent (or equivalent).

(a) Mix DDL (Duracryl acrylic lacquer and Flexible additive (DX-1798) and Duracryl lacquer thinner (DTL) as follows:

Duracryl Acrylic Lacquer DDL	Flexible Additive DX-1798	Duracryl DTL Thinner Yield
1 pint or 8 ounces	1 pint or 8 ounces	1-1/2 pints 3-1/2 pints or 12 ounces 1-3/4 pints

(b) Mix in the Duracryl (DDL) color and Flexible additive (DX-1798) thoroughly before adding the Duracryl thinner (DTL) best suited for the ambient temperature.

(c) Apply a minimum of eight to ten wet double coats,* allowing flash time between double coats. Use 30-35 pounds air pressure at the gun. As the film builds heavier, it will be necessary to allow longer flash off times between double coats to avoid trapping thinner. Trapped thinner can result in pinholing or bubbling.

Most colors will have adequate hiding after applying the minimum number of double coats. Some deep look colors may require additional double coats.

(d) Air dry for approximately four hours at 70°-85°F before installing or putting into service.

The new finish is naturally soft and pliable. When the proper Duracryl thinner (DTL) is used for the prevailing temperature, the finish should have adequate gloss. If compounding is desired, a minimum of two weeks should be allowed. Use only DXR-25 (a fine hand rubbing compound) or DRX-16 compound with a power buffer using only a very light pressure.

*See "Definitions of Technical Terms" on first page of "REFINISHING PROCEDURES".

WARNING: BECAUSE OF THE NATURE OF THE PRODUCTS SHOWN IN THESE FINISHING SYSTEMS, THEY MUST BE BLENDED WITH OTHER COMPONENTS. BEFORE OPENING THE PACKAGES. BE SURE YOU UNDERSTAND THE WARNING MESSAGES ON THE LABELS OF ALL COMPONENTS SINCE THE MIXTURE IS LIABLE TO HAVE HAZARDS IN ALL ITS PARTS. OBSERVE ALL APPLICABLE PRECAUTIONS.

SAFETY MEASURES

Use only with adequate ventilation. Do not take internally. Do not use if you have chronic (long term) lung or breathing problems, or if you have ever had

a reaction to isocyanates. If engineering and administrative controls of air contaminants are not feasible, use a fresh air supplied respirator that respirator supplier recommends as effective for isocyanate vapors and mists. Follow directions for respirator use. Wear the respirator for the whole time of spraying and until all vapors and mists are gone. Avoid breathing of vapor or spray mist. Avoid contact with eyes and skin.

PAINT BAKE OVEN TREATMENT (WITH TEXTURED GRILLES)

To avoid warpage, all models with textured grilles and bezels should be covered with paper or other material to shield grille assembly from heat before vehicle enters paint bake ovens, or be completely removed from vehicle.

FIBERGLASS FINISHES

Fiberglass should be treated much the same as body steel; however, it is a non-corrosive material and does not require chemical conditioners.

Replacement or new panels may contain silicone oils on the surface due to the manufacturing process used. These oils must be removed from the surface, to prevent cratering of the freshly painted surface.

Fiberglass Surface Preparation

Under most repair situations when working with fiberglass, the working area should be well ventilated, and consideration should be given to protective clothing. Respiratory masks and safety glasses should also be worn.

The procedure does not represent a complete fiber glass repair, but does reflect the basic steps to be taken in the repair.

(1) In a well ventilated area, using alcohol, wash new molded parts liberally with a clean cloth.

(2) Thoroughly clean the surface with wax and grease remover.

(3) Re-clean surface and wipe dry with clean rags.

(4) If there are joints to be filled or the sanding operation exposes air pockets or glass strands, glaze a coat of body filler over the entire surface.

(5) Allow to cure, sand and re-clean.

(6) Apply primer or surfacer as directed.

(7) Allow to dry and sand smooth with fine sandpaper to minimize sand scratches.

(8) Blow surface off with air and tack rag the surface.

(9) If enamel top coats are to be used a synthetic primer surfacer is also recommended.

(10) Apply color coats as recommended, by manufacturer.

Flexible Panel Repair and Refinishing (TPO)

Flexible bumper fascias on P-Body vehicles are thermoplastic olefin (TPO). For repair and refinish use 3M system 2 or equivalent. Important: Do not use repair and refinish methods for thermoplastic urethane (TPU) or RIM urethane.

Flexible Panel Repair (TPO)

It may not be necessary to replace a damaged flexible fascia if the damage is minor in nature.

Flexible panels are repairable using products such as 3M system 2, polytac adhesion promoter flexible parts repair, or equivalent. For best results, follow manufacturers instructions. Never use 3M flexible parts putty or body filler on thermoplastic olefin fascias.

Flexible Panel Refinish (TPO)

To eliminate outlie on repair area showing through top coat, apply coat of 3M flexible parts coating or equivalent.

CORPORATE IDENTITY CODE

Corporate White—8367

Corporate Blue—12785

Corporate Red—71831

The first two digits are accent or roof color. The second two digits are basic body color.
For special colors (coded 999) furnish Special Order (SO) Number.
Painted grilles are painted in exterior colors.

EXTERIOR COLORS

Paint Code	Color Name	Ditzler Number
DR5	Graphic Red	3709
ET1	Light Cream Clear	3834
EC7	Twilight Blue Pearl-Coat	3831
VC4	Glacier Blue Metallic Clear Coat	3600
DX8	Black Clear Coat	9700
FS8	Charcoal Pearl Coat	3836
CA1	Radiant Silver Metallic Clear Coat	3556
GW7	Bright White Clear Coat	4037

INTERIOR COLORS

Paint Code	Color Name	Ditzler Number
S8	Charcoal	33752
C5	Twilight Blue	16320
M6	Red	72398
K1	Almond	25771

HEATERS AND AIR CONDITIONING

CONTENTS

	Page		Page
AIR CONDITIONING	8	COMPRESSOR SERVICE	29
AIR CONDITIONING SERVICE		EVAPORATOR HEATER ASSEMBLY	36
PROCEDURES	26	HEATER	1
AIR CONDITIONING TEST		REFRIGERANT SYSTEM SERVICE	
PROCEDURES	11	PROCEDURES	22

HEATER

INDEX

	Page		Page
Defroster Duct	8	Heater Diagnosis	2
Faceplate	6	Resistor Block	7
General Information	1	Service Procedures	6
Heater Assembly	7	Temperature and Mode Control Cables	6
Heater Control	6		

GENERAL INFORMATION

Throughout this group, references may be made to a particular vehicle by number or letter designation. A Chart showing the breakdown of these designations is included in the Introduction Section at the front of this service manual.

All models use a **Blend-Air** type heater. Outside air enters the heater through the cowl opening and passes through a plenum chamber to the heater core. Hood louver air intake or air intake at rear of hood at windshield wiper opening must be kept free of snow, ice, and other obstructions for heater or air conditioning to pick up sufficient outside air. A temperature control door in the heater housing directs incoming air through the heater core and/or the heater core by-pass. The amount of blend (heated and non-heated air) is determined by the setting of the temperature lever on the instrument panel. Direction of the blended air is controlled by the **Heat-Defrost** lever on the instrument panel.

The blower switch, in conjunction with a resistor block, controls the speed of the blower motor, and hence the velocity of the air flow from the heater outlets.

The resistor block consists of two helically wound wire resistors connected to terminals which are mechanically attached to a glass-filled phenolic board. This assembly is bolted to the plenum.

The blower switch controls the blower motor speed by selectively connecting in series, one, two or none of the resistors to the blower motor.

A self-adjusting clip, on each of two control cables

has been incorporated to simplify cable adjustment. This clip snaps onto the control cable core wire and will slide along the wire under a specific load to provide an automatic cable adjustment.

Heater Output Check

Proper function of the heater system can be checked by measuring the temperature of the air at the heater output duct under the instrument panel. Set the heater controls, as shown below, and measure the temperature using a thermometer and compare them with the values listed in the reference chart. Should the temperature not meet the minimum values shown, refer to "Heater Diagnosis" for possible causes and corrections.

Test Conditions

- (1) Remove radiator pressure cap.

CAUTION: If vehicle has been run recently, wait 15 minutes before removing cap, then place a rag over the cap and turn it to the first stop. Allow pressure to escape through the overflow tube and when the system stabilizes remove the cap completely.

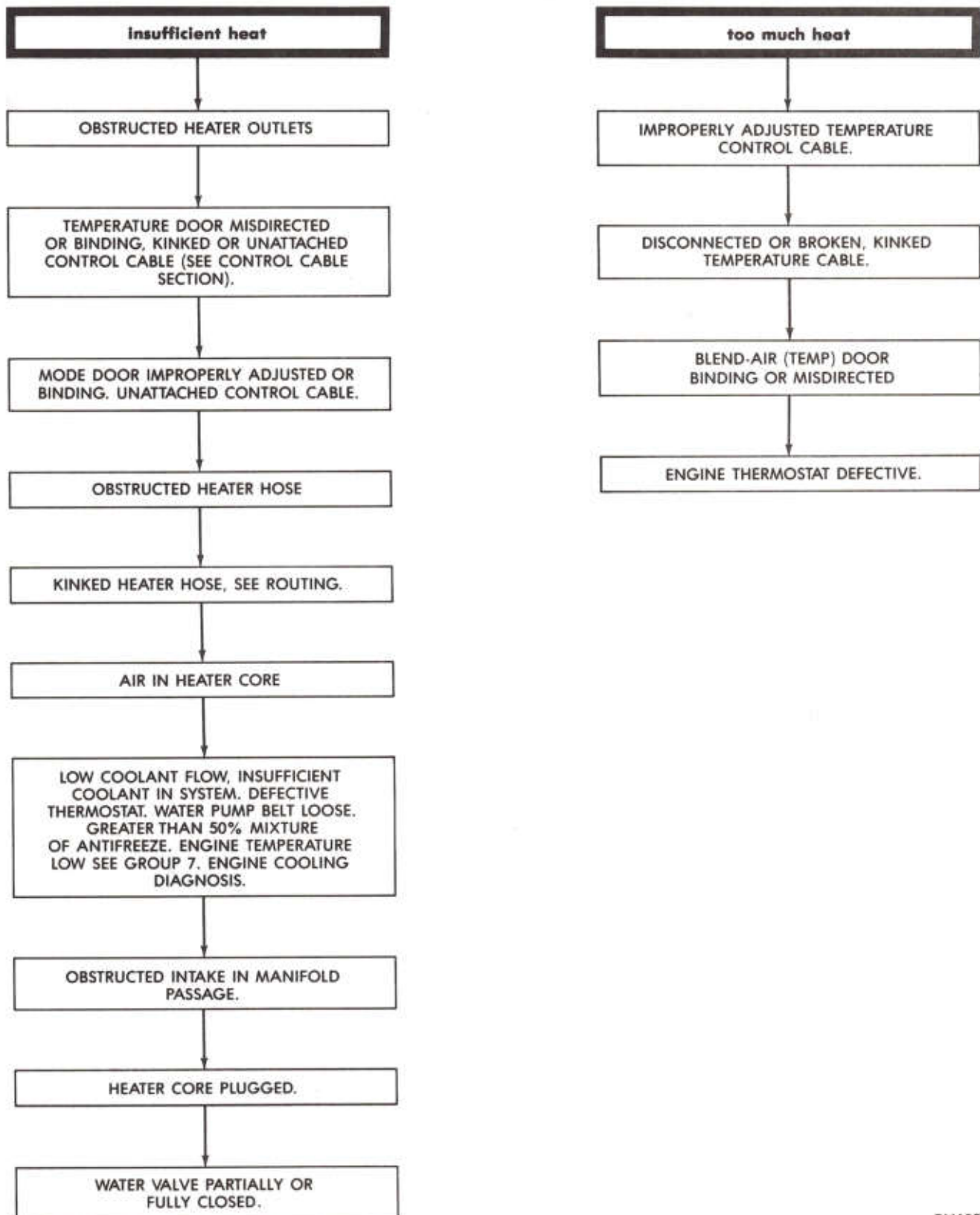
- (2) Drain one pint of coolant from the radiator.

(3) Warm the engine to operating temperature by idling for 20 minutes, with the pressure cap off. Idle longer if working outdoors in cold temperatures.

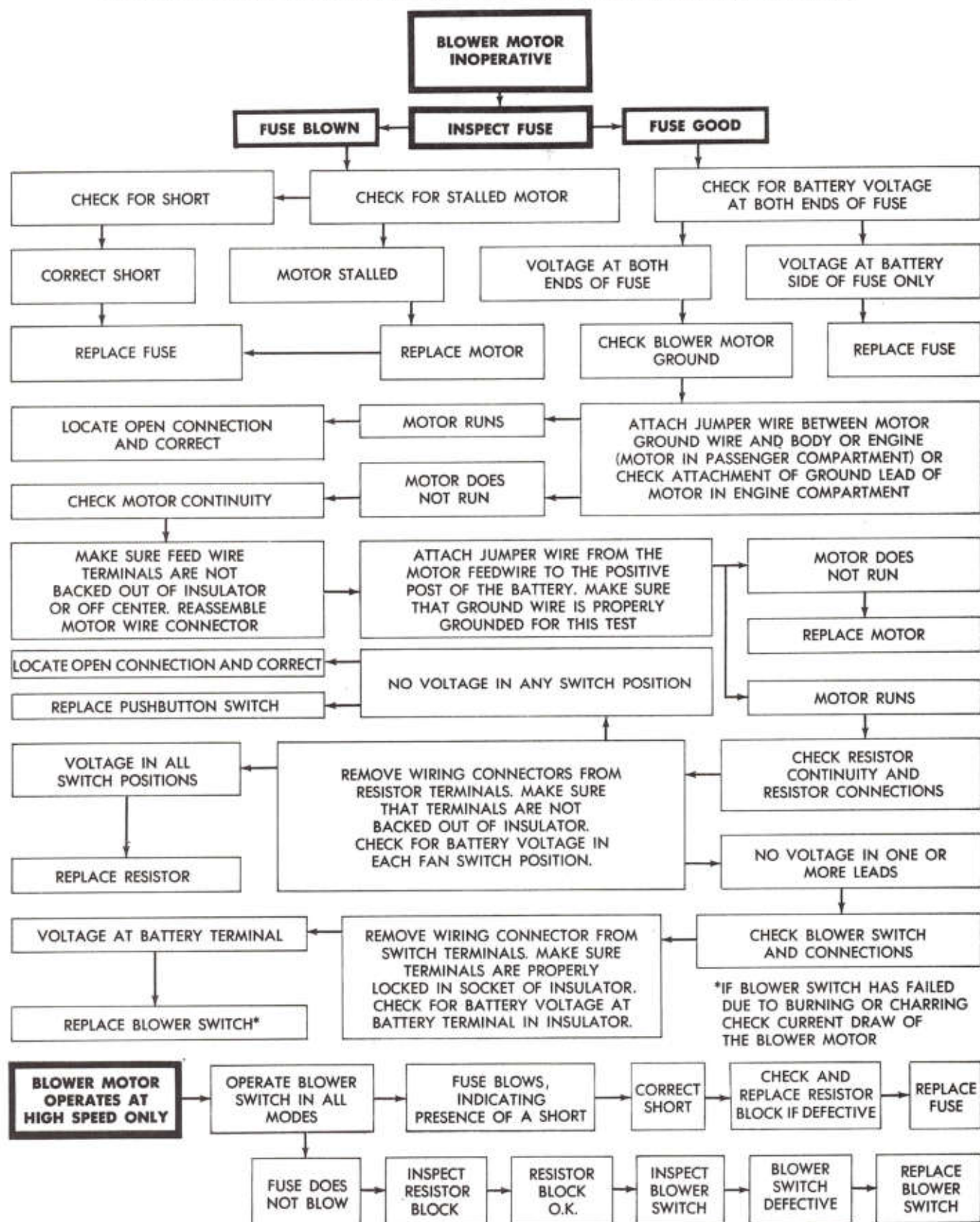
(4) With the engine idling, place a thermometer into the coolant in the radiator filler neck.

(5) Engine coolant temperature should stabilize at no lower than 187° (or 8° below the thermostat

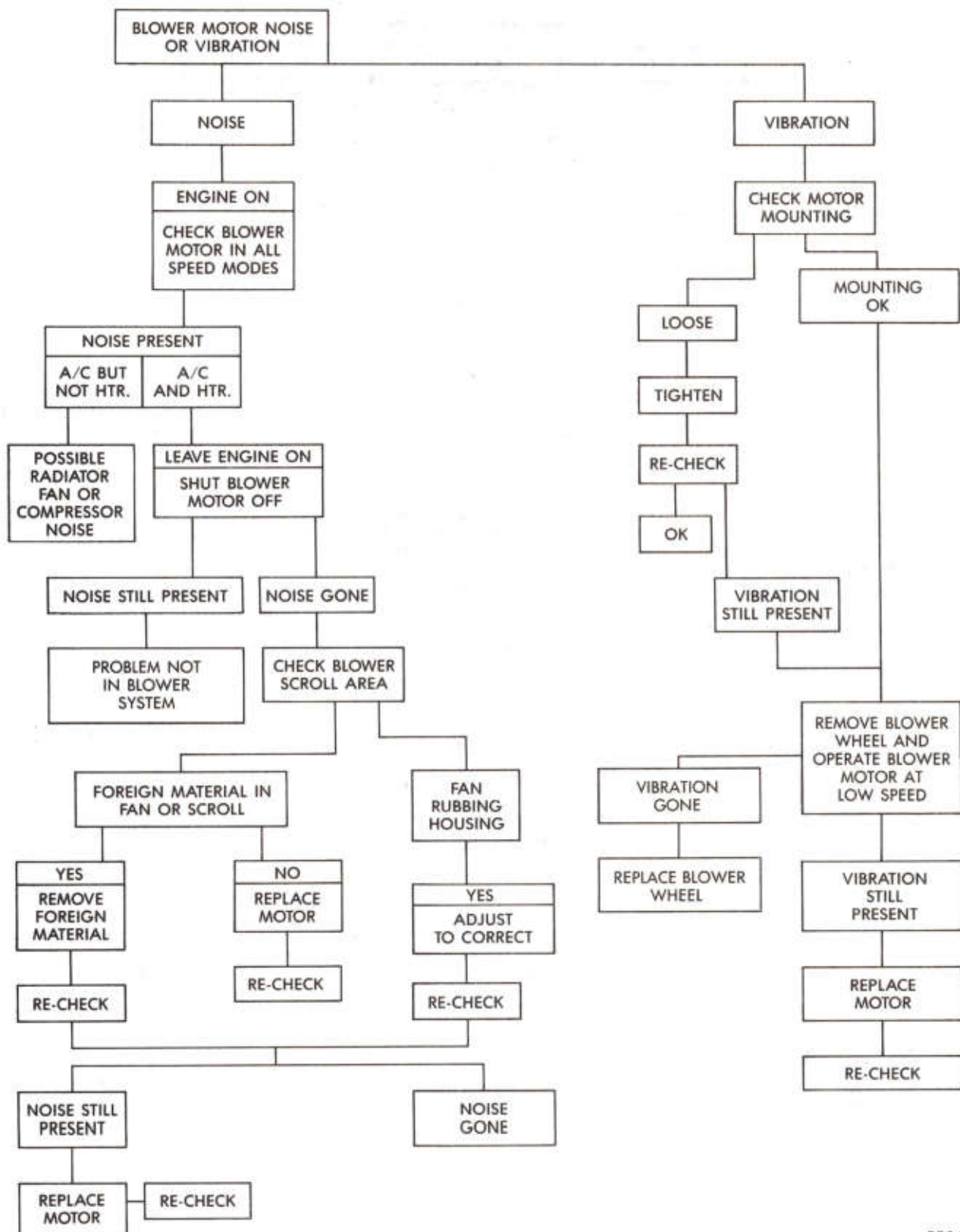
HEATER DIAGNOSIS (MECHANICAL)

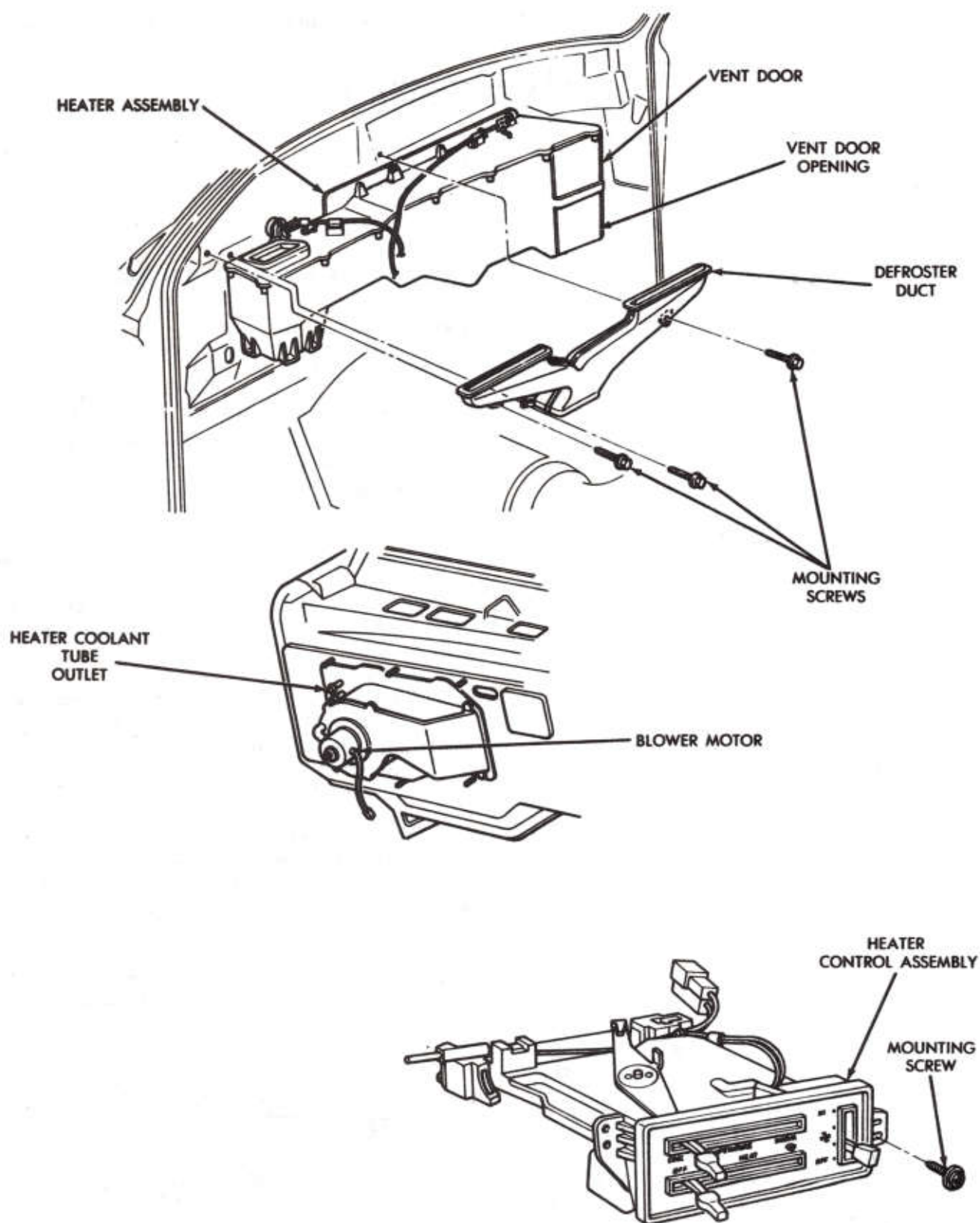


HEATER BLOWER MOTOR AND CONTROL SYSTEM DIAGNOSIS (ELECTRICAL)



BLOWER MOTOR NOISE/VIBRATION FLOW CHART





RB457B

Fig. 1—Heater Assembly

opening temperature) during the "fan-off" part of the vehicle operating cycle.

(6) Instrument panel control in **heat** mode.

(7) High blower speed.

(8) Temperature lever to maximum heat position.

SERVICE PROCEDURES

FACEPLATE

Removal

- (1) Remove map lamp (2 screws).
- (2) Remove six (6) screws which attach faceplate to base panel. Make sure the screw below the **Heater-A/C** control is removed (Fig. 2).
- (3) Pull column shift lever in position "1".
- (4) Remove faceplate by pulling the top edge rearward to clear the brow, disengage attaching clips around the bottom of the faceplate, and complete removal of faceplate.
- (5) Disconnect wires to four wheel drive indicator if so equipped.

Installation

- (1) Engage attaching clips around bottom of faceplate, connect four wheel drive indicator wiring if so equipped, roll faceplate into position, and install six (6) mounting screws (Fig. 2).
- (2) Install map lamp.

HEATER CONTROL

Removal

- (1) Remove faceplate (see "Faceplate Removal").
- (2) Remove two (2) attaching screws (Fig. 3).
- (3) Pull control outward.
- (4) Disconnect illumination light and switch wiring.
- (5) Remove cables.
- (6) Remove control unit.

Installation

- (1) Install cables.
- (2) Connect illumination light and switch wiring.

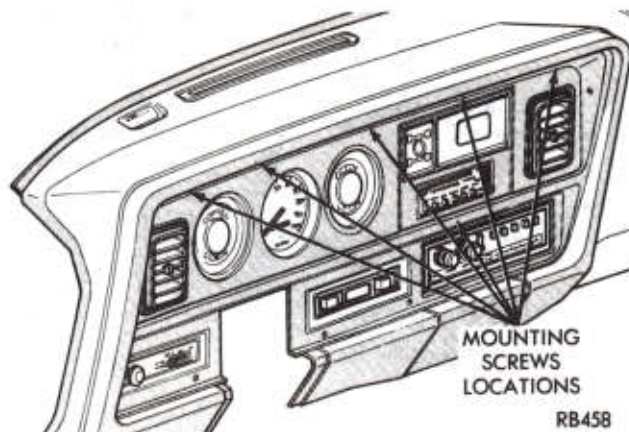


Fig. 2—Mounting Screw Locations

- (3) Install unit in instrument panel and secure with two mounting screws.
- (4) Move the levers to the extreme right to adjust the clips.
- (5) Install faceplate.

TEMPERATURE AND MODE CONTROL CABLES

Removal

- (1) Remove faceplate (see "Faceplate Removal").
- (2) Open glovebox past stops.
- (3) Remove control unit from instrument panel (see "Heater Control Removal").
- (4) Remove cables from control lever pins and remove flags from retainers (Figs. 4 and 5).
- (5) Detach cables from unit by removing self adjust clips from crank arms and removing flags from retainers (Fig. 6).
- (6) Remove cable assemblies through glovebox opening.
- (7) Place a 7mm (1/4 inch) I.D. tube over clip and pry self-adjust clip off core wire if required (Fig. 7).

Installation

- (1) Position self-adjust clip on cable core wire 50mm (2 inches) from the small loop at heater assembly flag end. With a 7mm (1/4 inch) I.D. tube, snap self-adjust clip on core wire.
- (2) Install cable assemblies through glovebox opening.
- (3) Attach self-adjust clips to crank arms and replace flags in receivers on heater assembly.
- (4) Install flags in retainers and attach cables to control levers on control unit.
- (5) Install control unit into instrument panel (see "Heater Control Removal").
- (6) Install faceplate (see "Faceplate Installation").
- (7) Move levers to extreme right to adjust clips.

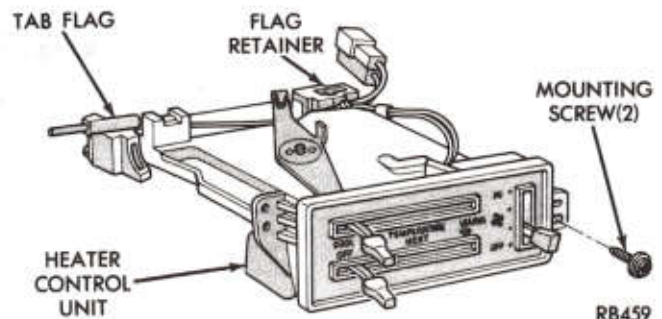


Fig. 3—Heater Control

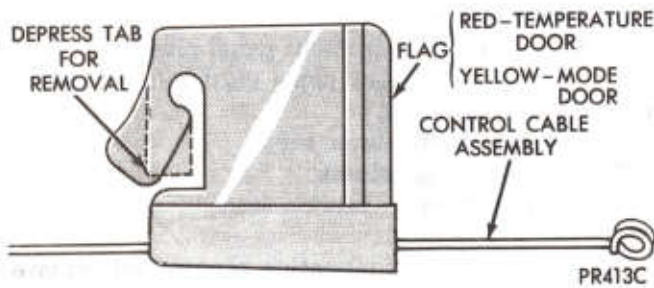


Fig. 4—Flag Tab Depressed for Removal

RESISTOR BLOCK

Removal

- (1) Remove connector.
- (2) Remove two (2) mounting screws and resistor block from plenum.

Installation

- (1) Install resistor block and secure with two mounting screws.
- (2) Install connector.

HEATER ASSEMBLY

Removal

- (1) Disconnect negative battery cable.
- (2) Remove water hoses on engine side and plug hoses and inlets on package (Fig. 8).
- (3) Remove right cowl side trim panel if so equipped.
- (4) Remove glovebox by removing four (4) mounting screws at base and swinging out from the bottom to avoid catch and stops.
- (5) Remove structural brace through glovebox opening.
- (6) Remove right half of instrument panel lower reinforcement (8 screws). Be sure to disconnect the ground strap.
- (7) Disconnect control cables (see "Control Cable Removal").
- (8) Disconnect blower motor wires on engine side.
- (9) Remove screw that retains package to cowl side

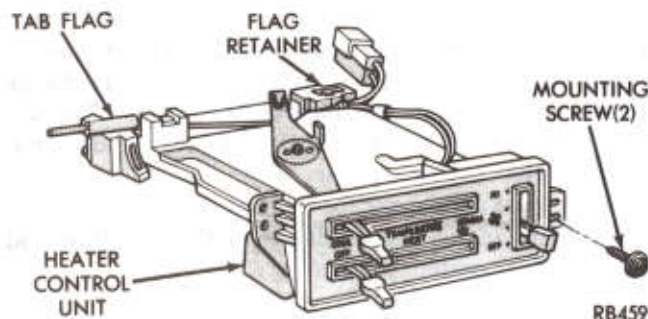


Fig. 5—Heater Control

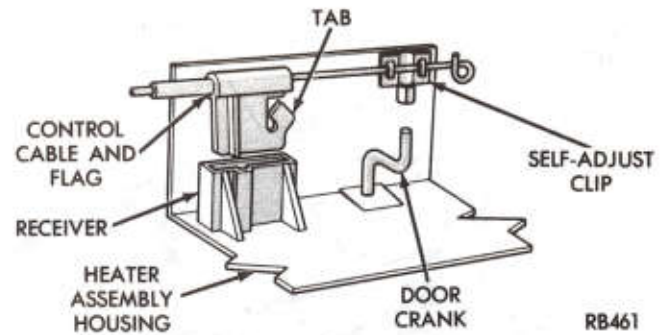


Fig. 6—Removing Cables from Unit

sheet metal.

- (10) Remove unit retaining nuts on engine side (6 nuts).
- (11) Remove unit.

Inspection

- (1) Remove fifteen (15) screws and mode door crank to separate cover from housing.
- (2) Carefully slide heater core out.
- (3) Peel dash panel seal below cover. Remove eight (8) retaining screws and remove cover from blower motor assembly.
- (4) Separate fan from motor, motor from housing and inspect all parts.
- (5) Reassemble heater assembly using necessary new parts.

Installation

- (1) Position heater assembly to dash and install retaining nuts on engine side (6 nuts).
- (2) Install cowl side retaining screws.
- (3) Connect blower motor.
- (4) Connect control cables (see "Control Cable Installation").
- (5) Install right, lower instrument panel reinforcement (8 screws).
- (6) Install structural brace through glovebox opening.
- (7) Install glovebox (4 screws).

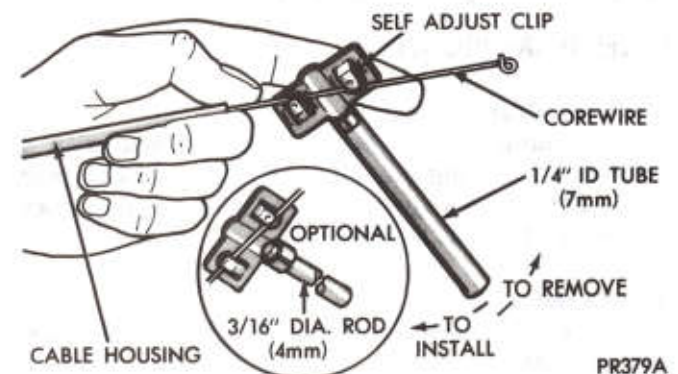


Fig. 7—Removing or Installing Self-Adjust Clip

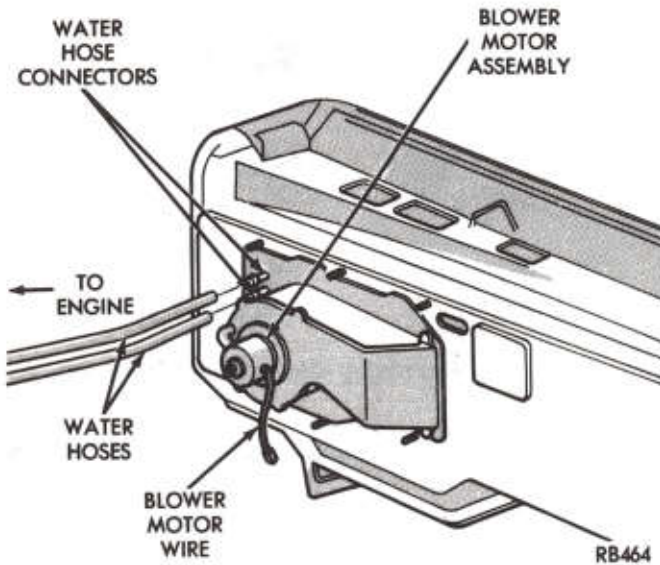


Fig. 8—Water Hose Connections

- (8) Install right cowl side trim panel is so equipped.
- (9) Unplug inlets and water hoses and connect hoses to inlets on package (Fig. 8).
- (10) Connect negative battery cable.

DEFROSTER DUCT

Removal

- (1) Disconnect negative battery cable.
- (2) Open glovebox past stops.
- (3) Remove right upper air duct by removing one (1) mounting screw and pulling duct out through glovebox openings, if so equipped.
- (4) Remove instrument panel center brace.

- (5) Remove right kick pad.
- (6) Remove right instrument panel pivot bolt.
- (7) Remove instrument panel cluster (see "Instrument Panel", Group 8).
- (8) Disconnect shift lever cable.
- (9) Lower steering column.
- (10) Remove steering column studs.
- (11) Remove radio.
- (12) Remove two (2) mounting screws and remove scoop connecting heater unit to center distribution duct, if so equipped.
- (13) Remove two (2) mounting screws and remove center distribution duct by pulling bottom of instrument panel out and dropping duct out, if so equipped (Fig. 11).
- (14) Remove heater control (see "Heater Control Removal").
- (15) Remove three (3) mounting screws and then cover that retains instrument panel wiring and let wiring hang free.
- (16) Remove one (1) mounting screw and slide left air duct out through instrument cluster opening, if so equipped.
- (17) Remove three (3) screws attaching defroster duct to dash panel.
- (18) Reach in through instrument panel opening and disengage snaps to separate defroster duct into two pieces.
- (19) Remove defroster duct halves through instrument cluster opening.

Installation

To install defroster duct, reverse removal procedure.

AIR CONDITIONING

INDEX

	Page
A/C System Component	10
Diagnosing Air Conditioning	11
Manifold Gauge Set Installation	10

	Page
General Information	8
Safety Precautions	9

GENERAL INFORMATION

Radiator Cap

Air conditioned vehicles must be equipped with a radiator cap having a holding pressure of 14-18 psig (98 to 122 kPag). Replace the radiator cap that does not test within this specification.

Condenser

Inspect the condenser for obstruction or foreign matter. Clean if present.

Any obstruction to the free flow of air across the condenser will decrease heat dissipation from the condenser, decrease the efficiency of the condenser

and, in turn, decrease the evaporator's efficiency. These conditions result in increasing the discharge pressure and horsepower load on the engine. The use of a bug screen is not recommended, it also will decrease the free flow of air.

Inspect the condenser for bent or damaged fins.

The bent fins on the condenser deflect air flow and decrease the condenser area.

Bug Screens

Bug screens should **not** be installed on vehicles equipped with air conditioning. A bug screen installed

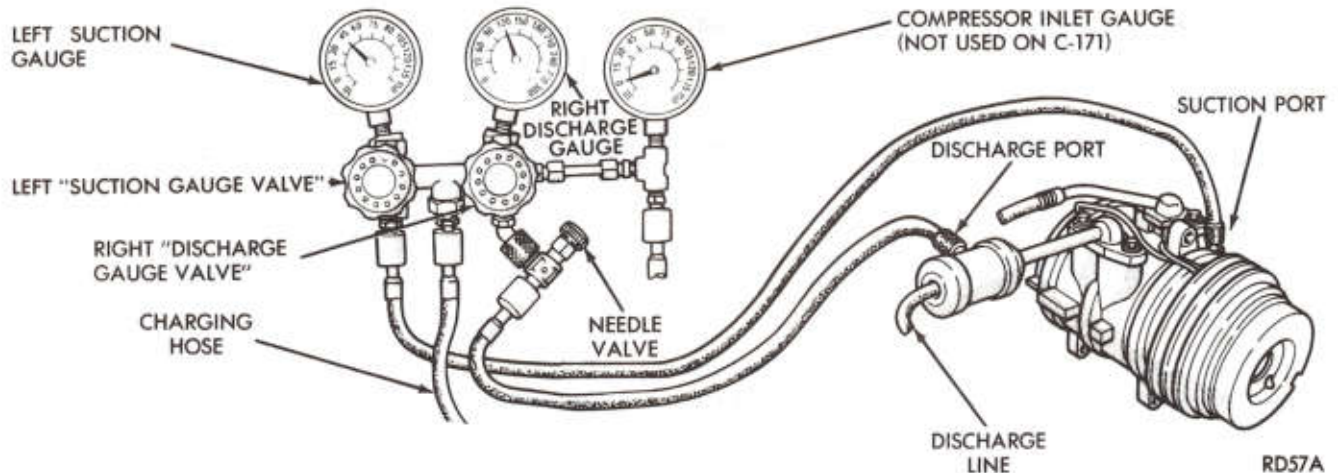


Fig. 1—Manifold Gauge Set Connections (Typical)

in front of the condenser will reduce air flow and air conditioner performance. Under severe heat conditions a bug screen may cause the engine to over-heat.

Resistor Block

The blower motor switch, in conjunction with a resistor block, controls the speed of the blower motor and the velocity of the air flow from the heater or air conditioning outlets. The resistor block consists of 3 helically-wound wire resistors, connected to terminals which are mechanically attached to a phenolic board. This assembly is bolted to the plenum.

The blower switch controls the blower motor speed by selectively connecting in series one, two, three or none of the resistors to the blower motor.

SAFETY PRECAUTIONS

The refrigerant used in all air-conditioning installations is Refrigerant 12. It is transparent and colorless in both the liquid and vapor state. Since it has a boiling point of -21.7°F (-29.8°C), at atmospheric pressure, it will be a vapor at all normal temperatures and pressures. The vapor is heavier than air, non-flammable and nonexplosive.

CAUTION: It is non-poisonous except when it is in direct contact with open flame.

It is noncorrosive except when combined with water. The following precautions must be observed when handling Refrigerant 12.

CAUTION: Wear safety goggles when servicing the refrigeration system.

Refrigerant 12 evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes.

Always wear safety goggles when servicing the refrigeration part of the air-conditioning system. Keep

a bottle of sterile mineral oil handy when working on the refrigeration system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out. Refrigerant 12 is rapidly absorbed by the oil. Next, splash the eyes with plenty of cold water. Call your doctor immediately even though irritation has ceased after first aid treatment.

WARNING: DO NOT HEAT REFRIGERANT 12 ABOVE 125 DEGREES F. (52°C). THE CAN MAY EXPLODE.

In most instances, moderate heat is required to bring the pressure of the refrigerant in its container above the pressure of the system when charging or adding refrigerant. A bucket or large pan of hot water not over 125°F (52°C) is all the heat required for this purpose. Do not heat the refrigerant container with a blow torch or any other means that would raise temperature and pressure above this temperature. Do not weld or steam clean on or near the system components or refrigerant lines.

CAUTION: Keep Refrigerant 12 containers upright when charging system.

When metering Refrigerant 12 into the refrigeration system, **keep the supply tank or cans in an upright position.** If the refrigerant container is on its side or upside down, liquid refrigerant will enter the system and damage the compressor.

CAUTION: Always work in a well-ventilated room.

Always maintain good ventilation in the working area. Always discharge the refrigerant into the service bay exhaust system or outside the building. Large quantities of refrigerant vapor in a small, poorly ventilated room can displace the air and cause suffocation.

Although Refrigerant 12 vapor is normally non-poisonous, it can be changed into a very poisonous gas if allowed to come in contact with an open flame. Do not discharge large quantities of refrigerant in an area having an open flame. A poisonous gas is produced when using the flame-type leak detector. Avoid inhaling the fumes from the leak detector.

CAUTION: Do not allow liquid refrigerant to touch bright metal.

Refrigerant will tarnish bright metal and chrome surfaces. Avoid splashing refrigerant on any surface. Refrigerant in combination with moisture is very corrosive and can cause great damage to all metal surfaces.

MANIFOLD GAUGE SET INSTALLATION (ALL MODELS)

The Manifold gauge set, Tool C-3740A, has two compound gauges and one discharge pressure gauge. With the C171 compressor only suction and discharge gauges are used. In this case the compressor inlet gauge can be left disconnected.

Evaporator Suction Gauge—the left side of the manifold set is calibrated to register 0 to 30 inches of vacuum (0 to -100 kPag) and 0 to 150 psig (0 to 1000 kPag). This gauge is connected to the suction service port of the compressor. A special service port adapter, supplied with the gauge set, provides the means of connecting the gauge set manifold hose to the service port. When the adapter is installed at the port and tightened, the stem of the valve in the service port is depressed, opening the service port valve.

Discharge Pressure Gauge—the center of the manifold set is calibrated to register 0 to 300 psig (0 to 2100 kPag). For all tests this gauge is connected to the discharge service port of the system. The needle valve, located below the discharge pressure gauge, is used to damp out gauge needle oscillations so that accurate readings can be obtained.

Center Manifold Outlet—provides the necessary connection for a long service hose used when discharging the system, using a vacuum pump to "pull a vacuum" before charging the system, and for connecting the supply of refrigerant when charging the system.

Manifold Gauge Valves—should be closed when connecting the gauge set manifold to the service ports

of the compressor. The suction gauge valve at the left is opened to provide a passage between the suction gauge and the center manifold outlet. The discharge gauge valve at the right is opened to provide a passage between the discharge pressure gauge and the center manifold outlet.

Detailed instructions for proper use of the manifold gauge set are contained in the test covering each service operation employing these gauges.

A/C REFRIGERANT SYSTEM COMPONENTS

Compressor—The prime purpose of the compressor is to compress the low pressure refrigerant vapor from the evaporator into a high pressure, high temperature vapor. The six cylinder C-171 compressor is used on all models.

Clutch Pulley and Coil—are mounted on the compressor providing a convenient way to drive it and disengage it in accordance to the cooling needs.

Condenser—is located in front of the engine cooling radiator. Its function is to cool the hot, high pressure refrigerant gas causing it to condense into high pressure liquid refrigerant.

Filter-Drier—is used to remove any traces of moisture from the refrigerant system. This component incorporates the sight glass and the high pressure relief valve.

Sight Glass—(at the top of the filter drier) is provided as a diagnostic tool to observe refrigerant flow and indicate refrigerant level.

High Pressure Relief Valve—is a safety device designed to open automatically if the system pressure reaches a predetermined level; it prevents system component damage.

Expansion Valve—the H-valve is used for all applications. Its function is to meter refrigerant into the evaporator in accordance with cooling requirements.

Evaporator Coil—is located in the A/C unit and its function is to cool and dehumidify the air before it enters the vehicle.

Freeze Control—The main function of a freeze control is to prevent condensate water on the face of the evaporator coil from freezing and restricting the airflow. To perform this function, a damped pressure cycling switch (Fig. 2) is located on the refrigerant plumbing (suction line) near the H-valve, and is electrically in series with the A/C clutch coil. It is an on-off switch which turns the compressor on-off depending on the pressure in the suction line. The switch is a sealed, specially calibrated unit and if found defective, must be replaced.

Refrigerant Lines—are needed to carry the refrigerant between the various system components.

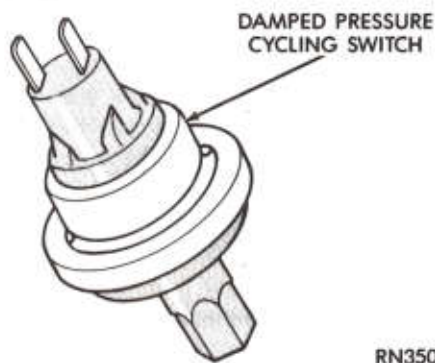


Fig. 2—Damped Pressure Cycling Switch

Service Valves—at the compressor and the discharge muffler are used to test and service the refrigerant system.

For safety reasons, the high pressure fitting has

been changed to meet SAE safety practice J639. A special adapter is required for performance testing (C4803).

DIAGNOSING AIR CONDITIONING

The reason for owner dissatisfaction must be thoroughly understood before any attempt is made to repair or replace any parts. It must be determined if the condition is the refrigerant system, air conditioning air flow, or related to the compressor. After confirming the condition, a functional test involving one of the following diagnostic charts is suggested.

After the condition has been properly diagnosed and corrected, check out the complete system to assure that it is performing satisfactorily.

The following charts have been developed for quick reference. If the step by step method used is not completely understood, see the correct section of the Service Manual for detailed explanations.

TEST PROCEDURES

INDEX

	Page
Compressor Oil Level	17
Damped Pressure Cycling Switch	16
Expansion Valve (H-Type)	16
Expansion Valve (H-Type) Test (C-171 Compressor)	20

	Page
High Pressure Relief Valve	16
Overall Performance Test	19
Sight Glass Refrigerant Level Test	11
Testing System for Leaks	17

SIGHT GLASS REFRIGERANT LEVEL TEST

The sight glass, which is an integral part of the filter-drier, is a refrigerant level indicator (Fig. 1). To check the refrigerant level, clean the sight glass and start the engine. Place the air conditioning controls on A/C, the fan switch on high and the temperature lever on cool. The room temperature should be at least 70°F (21°C). After operating for a few minutes in this manner, check the sight glass.

(1) If the sight glass is clear, the A/C clutch is engaged, the compressor discharge line is warm and the compressor inlet line is cool; the system has a full

charge.

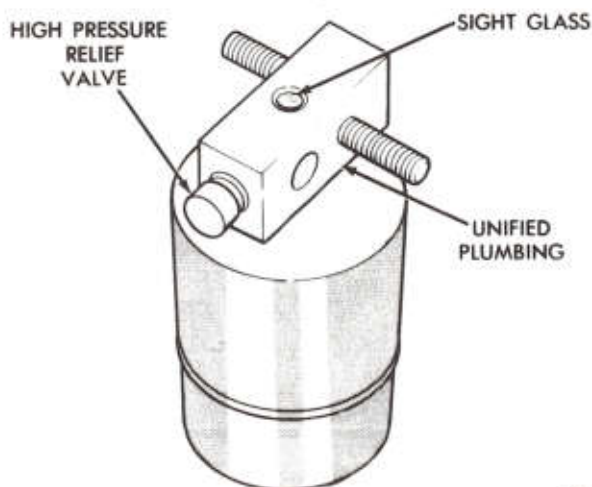
(2) If the sight glass is clear, the A/C clutch is engaged and there is no significant temperature difference between compressor inlet and discharge lines; the system is empty or nearly empty. Connect a gauge to the compressor discharge port. If the gauge reads less than 25 psi (172 kPag), the damped pressure cycling switch has failed.

(3) If the sight glass is clear and the A/C clutch is disengaged; the clutch is defective or, the clutch circuit is open, or the system is out of refrigerant. Perform damped pressure cycling switch test to determine condition.

(4) If the sight glass shows foam or bubbles, the system could be low on charge. Occasional foam or bubbles is normal when the room temperature is above 110°F (43°C) or below 70°F (21°C).

Adjust the engine speed to 1300 rpm. Block the airflow thru the condenser to increase the compressor discharge pressure to 225 to 250 psig (1552 to 1724 kPag). If sight glass still shows bubbles or foam, system charge level is low.

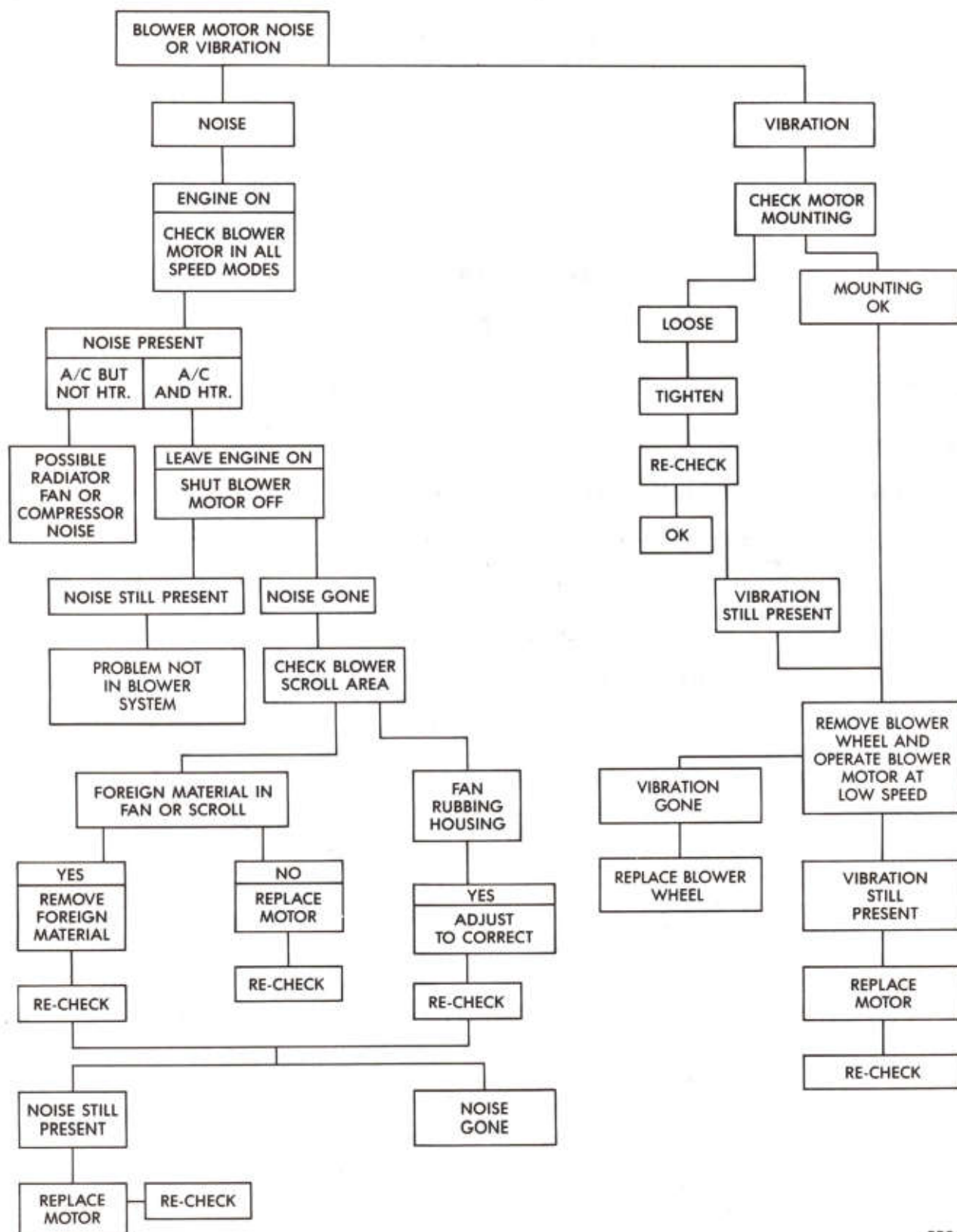
The refrigerant system will not be low on charge unless there is a leak. Find and repair the leak. If the leak can be repaired without discharging the system, the low refrigerant charge level can be corrected as follows. Maintaining the discharge pressure of 225 to 250 psig (1550 to 1720 kPag), add refrigerant gas through compressor suction line until foam is cleared from sight glass. Then add 13 oz. (368 g) or one can of refrigerant.



RY305B

Fig. 1—Filter Drier (Typical)

BLOWER MOTOR NOISE/VIBRATION FLOW CHART



HIGH PRESSURE RELIEF VALVE

The **High Pressure Relief Valve** is located on the filter-drier. Its function is to prevent damage to the air conditioning system in the event that excessive pressure develops due to condenser air flow being restricted by, for example, leaves, newspaper, an overcharge of refrigerant or air in the system.

The high pressure relief valve vents only a small amount of refrigerant necessary to reduce system pressure and then reseats itself. The majority of the refrigerant is conserved in the system. The valve is calibrated to vent at a pressure of 450 to 550 psig. (3100 to 3790 kPag), therefore, the fact that the valve vented refrigerant, does not mean the valve is defective. The valve is part of the filter-drier assembly and must not be removed nor otherwise disturbed.

On new filter-drier assemblies, a mylar disc is applied to the venting port of the valve. The disc is primarily intended for the protection of the valve during the painting operation of the bottle. A missing or damaged disc does not indicate failure. If the mylar disc has loosened or come off, it is recommended to apply a drop or two of refrigerant oil into the valve mechanism through the venting holes periodically, this will prevent salt, dirt, or moisture from affecting the valve.

DAMPED PRESSURE CYCLING SWITCH

The damped pressure cycling switch is located on the refrigerant plumbing, suction line near the H-valve and is electrically in series with the clutch coil. It is an on-off switch which turns the compressor on and off depending on the pressure in the suction line. The switch is sealed, specially calibrated unit and if found defective, must be replaced.

Testing

- (1) Remove the wires (boot connector) from the damped pressure cycling switch.
- (2) Check continuity of the switch. Switch contacts

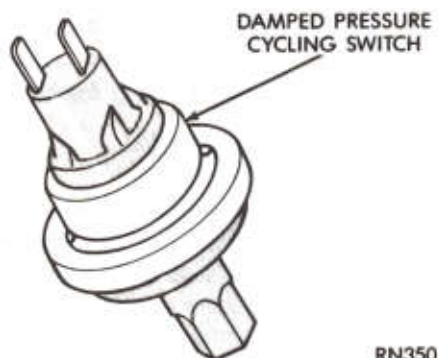


Fig. 2—Damped Pressure Cycling Switch

are closed at temperatures above 7°C (45°F). If no continuity, replace switch.

(3) If contacts are closed, verify switch operation as follows:

- (a) Reconnect wires to pressure cycling switch.
- (b) Set temperature control lever to full cool position.
- (c) Set A/C blower motor on low speed and push A/C button.
- (d) Operate engine at 1300 rpm for approximately 5 minutes to stabilize the A/C system and verify that refrigerant system is full.
- (e) If the compressor clutch cycles on and off 2 to 3 times per minute with temperature between 20° to 32°C (68° to 90°F), the pressure cycling switch is normal. If the compressor clutch fails to engage, check for continuity in the electrical circuit. Above 32°C (90°F) the compressor clutch may be continuously engaged (non-cycling) due to the high heat load. This condition is normal.

Removal

- (1) Remove the electrical wires to the switch.
- (2) Rotate switch counterclockwise to remove from pressure switch port.
- (3) Remove and discard old O-ring.

Installation

- (1) Install new O-ring. Refrigerant oil must be applied to the new O-ring.
- (2) Rotate switch clockwise to install on suction line pressure switch port. Tighten switch to 50 ± 5 in. lbs. torque.

CAUTION: Power tools should not be used for installation of the switch. The possibility of stripping the switch threads occurs above 52 in. lbs. torque.

- (3) Reconnect wires.
- (4) Verify operation.

EXPANSION VALVE (H TYPE) (Fig. 3)

Removal

The system must be completely discharged before opening any refrigerant lines.

- (1) Remove the 8 mm x 30 mm x 1.25 thread bolt in center of plumbing sealing plate.
- (2) Carefully pull refrigerant line assembly towards front of vehicle (take care **not** to scratch valve sealing surfaces with tube pilots).
- (3) Remove two 1/4-20 Torx Head screws. (Hold valve, once cap screws are removed valve is completely disconnected).
- (4) Carefully remove valve.

Installation

- (1) Remove and replace two aluminum N-gaskets (1 on evaporator plate and 1 on plumbing plate).

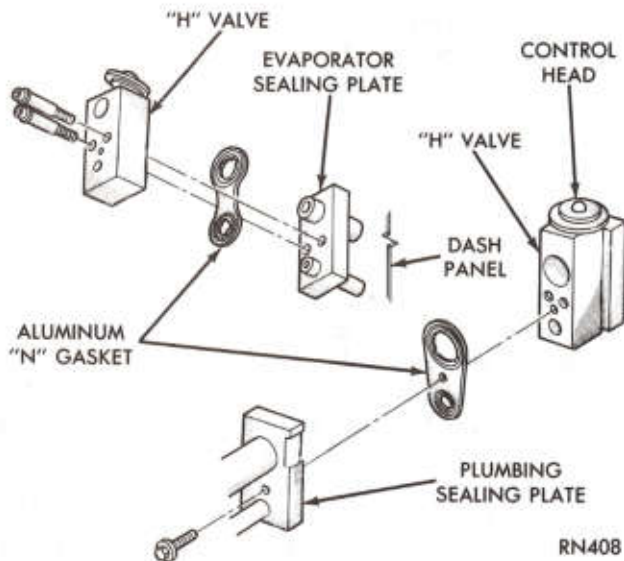


Fig. 3—H-Valve Assembly

(2) Remove sealing cap from H-valve control head side sealing surface only and carefully hold it against evaporator sealing plate (do not scratch sealing surface) and install two 1/4-20 NC Torx Drive Screws and tighten 100 ± 30 inch pounds (11 ± 3 N·m).

(3) Remove sealing cap from plumbing side sealing surface and carefully hold plumbing up to valve and install the 8mm x 30mm x 1.25 thread bolt and tighten to 200 ± 30 inch pounds (23 ± 3 N·m).

(4) Connect wires to damped pressure cycling switch.

(5) After expansion valve is installed and system charged and leak checked, repeat performance check.

TESTING THE SYSTEM FOR LEAKS

If the air conditioning system is not cooling the passenger compartment properly, determine whether the refrigerant system is fully charged with R12 by following the procedures in the "Sight Glass Refrigerant level Test" section of this group.

If the refrigerant system is empty or low in refrigerant charge, a leak at any of the line fittings or component seals is likely (Fig. 4). To detect a leak in the refrigerant system, perform one of the following procedures as indicated by the symptoms.

Empty Refrigerant System Leak Test

(1) Evacuate the refrigerant system to the lowest degree of vacuum possible. See "Evacuating the System" for instructions.

(2) Prepare a 14 oz. refrigerant (R12) charge to be injected into the system. See "Charging the System"

for instructions.

(3) Connect and dispense 14 ozs. of refrigerant (R12) into the evacuated refrigerant system. See "Charging the System".

(4) Proceed to step (2) of Low Refrigerant Level Leak Test.

Low Refrigerant Level Leak Test

(1) Review the "Safety Precautions" section of this group to determine if there is still R12 in the refrigerant system.

(2) Position the vehicle in a breeze free work area to make it less difficult to detect a small leak.

(3) With the engine not running, use an "Electronic Leak Detector" (or equivalent) and search for leaks (Fig. 12) in the most accessible areas first.

(a) Fittings, lines, or components that appear oily usually will implicate a refrigerant leak.

(b) To inspect the evaporator core for leaks, it is possible to insert the leak detector probe into the opening on the right side of the instrument panel.

(4) Refer to "Refrigerant Leak Repair Procedures" for more information.

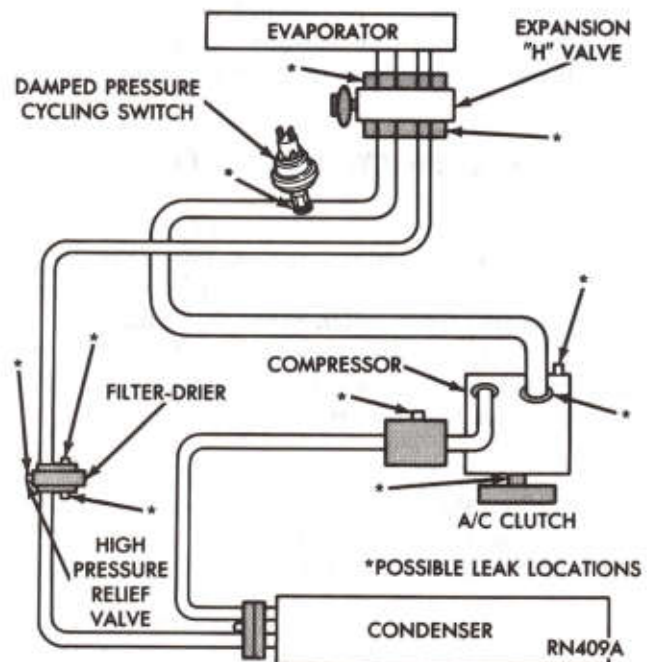
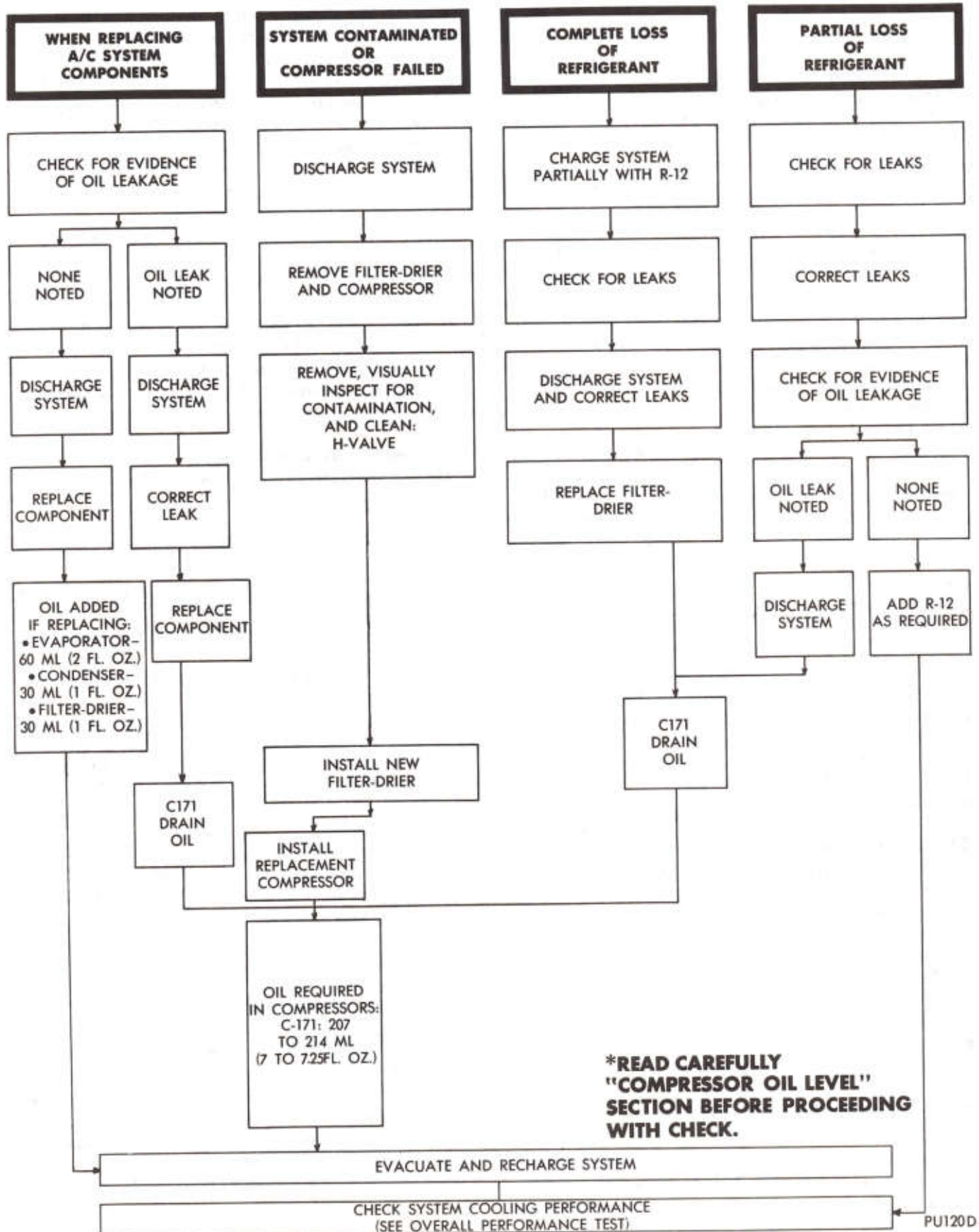


Fig. 4—Testing for Leaks

COMPRESSOR OIL LEVEL

It is important to have the correct amount of oil in the A/C system to ensure proper lubrication of the compressor. Too little oil will result in damage to the compressor, while too much oil will reduce the cooling capacity of the system and consequently result in higher discharge air temperatures.

COMPRESSOR OIL LEVEL ADJUSTMENT*



To provide the desired balance for adequate lubrication and cooling capacity, each compressor is charged with 7 to 7.25 fl. oz. (207 to 214 ml) of oil at the factory.

The oil used in the compressors is a 500 SUS viscosity, wax-free refrigerant oil. Only refrigerant oil of the same type should be used to service the system. (Do not use any other oil). The oil container should be kept tightly capped until it is ready for use, and then tightly capped after use to prevent entrance of dirt and moisture. Refrigerant oil will quickly absorb any moisture it comes in contact with.

After the compressor has been installed and operated in the A/C system, the oil will be distributed throughout the system. Some of the oil will be trapped by components in the system. An equivalent amount of oil must be added to the system to compensate for the trapped oil when replacing the following:

Evaporator Coil: 2 fl. oz. (59.2 ml)

Condenser: 1 fl. oz. (30 ml)

Filter-Drier: 1 fl. oz. (30 ml)

It will not be necessary to check oil level in the compressor or to add oil unless there has been an oil loss due to a ruptured line, shaft seal leakage, leakage from the evaporator, condenser, filter-drier, or loss due to a collision. Oil loss at a leak point will be evident by the presence of a wet, shiny surface around the leak.

Replacement compressors are also charged with 7-7.25 fl. oz. (207-214 ml). When replacing compressor, remove, drain oil, measure amount and discard old oil. For the replacement compressor use the same amount of refrigerant oil as recovered from the failed compressor. This adjustment is not needed if the system has been flushed, removing retained oil.

The Oil Level Adjustment Chart should be followed to determine the need to perform an oil level adjustment.

Check Oil Level (Basic Fill)

- (1) Slowly discharge complete system.
- (2) With system discharged, disconnect suction and discharge lines, remove compressor, drain and discard oil through suction port and discharge port on top.
- (3) Add 5 fluid ounces (148 ml) of clean refrigerant oil through the suction port.
- (4) Install compressor, install and tighten suction and discharge lines to compressor. Use new gaskets to prevent leakage.
- (5) Evacuate and charge system.

OVER-ALL PERFORMANCE TEST

Humidity has an important bearing on the temperature of the air delivered to the vehicle's interior. This is true of all air-conditioning systems. It is important

to understand the effect humidity has on the performance of the system. When humidity is high, the evaporator has to perform a double duty. It must lower the air temperature and the temperature of the moisture carried in the air. Condensing the moisture in the air transfers a great deal of heat energy into the evaporator fins and tubing. This reduces the amount of heat the evaporator can absorb from the air. In other words, high humidity greatly reduces the evaporator's ability to lower the temperature of the air delivered to the vehicle interior.

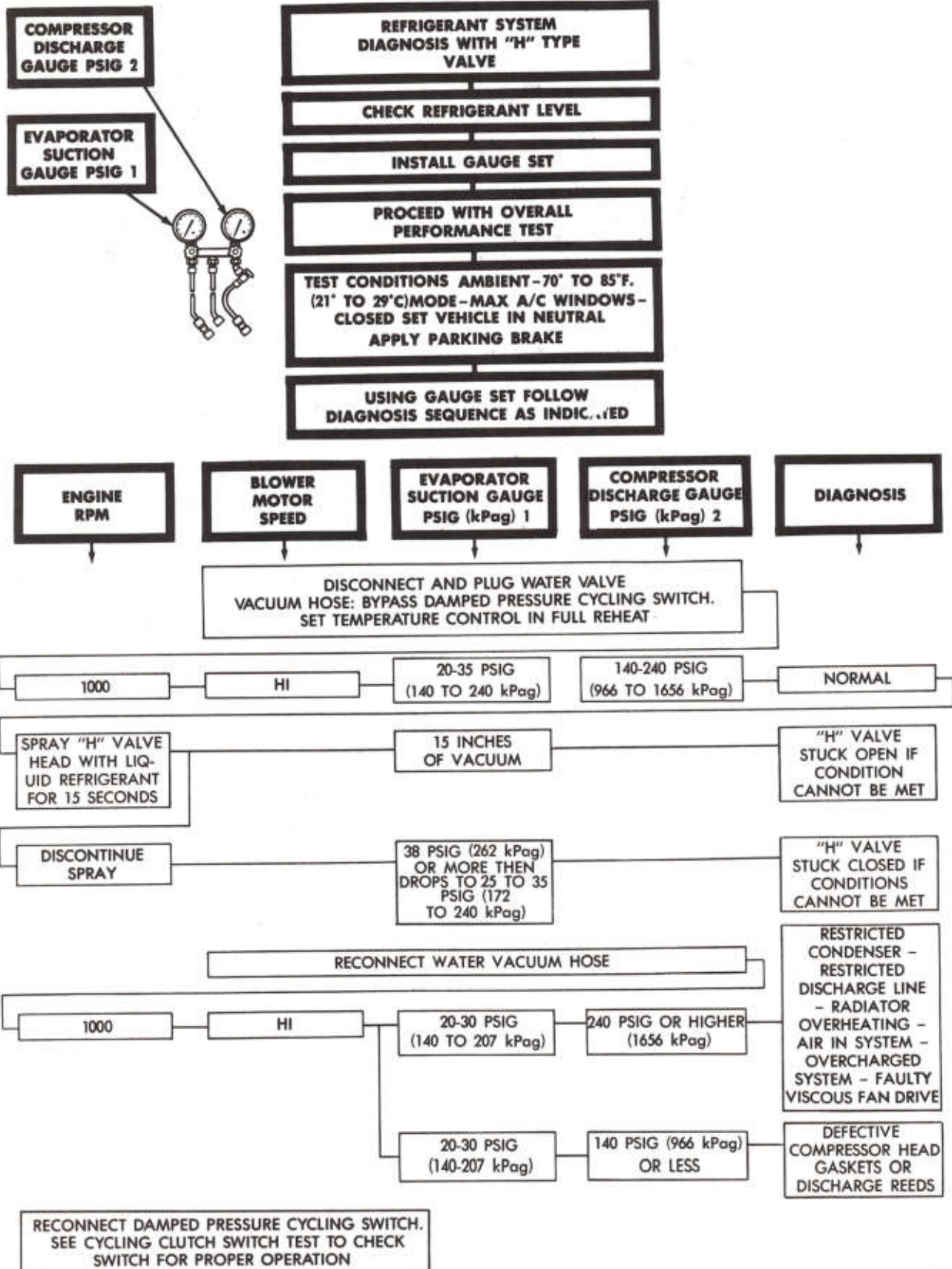
Evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. However, an owner may expect too much from their air-conditioning system on humid days. A performance test is the best way to determine whether or not the system is performing up to standard. This test also provides valuable clues to the possible cause of trouble.

Performance Test Procedure

Air temperature in test room must be 70°F (21°C) minimum for this test.

- (1) Connect a tachometer and manifold gauge set (Fig. 5).
- (2) Set A/C controls to Max A/C, temperature lever on full cool, and blower on high.
- (3) Start engine and adjust rpm to 1000 with A/C clutch engaged.
- (4) Engine should be warmed up with doors, windows, and hood closed.
- (5) Insert a thermometer in the left center A/C outlet and operate the engine for 5 minutes. The A/C clutch may cycle depending on ambient conditions.
- (6) After 5 minutes note the discharge air temperature. (If the clutch cycles take the reading before the clutch disengages).
- (7) Open the hood and disconnect the gray vacuum line going to the heater water control valve. Observe the valve arm for movement as the line is disconnected. If it does not move refer to the heater valve controls sections of this group. Plug the vacuum line to prevent leakage.
- (8) Operate the A/C for 2 more minutes and take the discharge air temperature reading again. If the temperature increased by more than 5°F (2°C), check the blend air door cable for correct operation. If the temperature does not increase more than 5°F (2°C), compare the discharge air temperature, suction, and discharge pressures with the values in the performance chart corresponding with the garage ambient temperature. Reconnect the gray vacuum line.
- (9) If the discharge air temperature fails to meet the

C-171 COMPRESSOR DIAGNOSIS



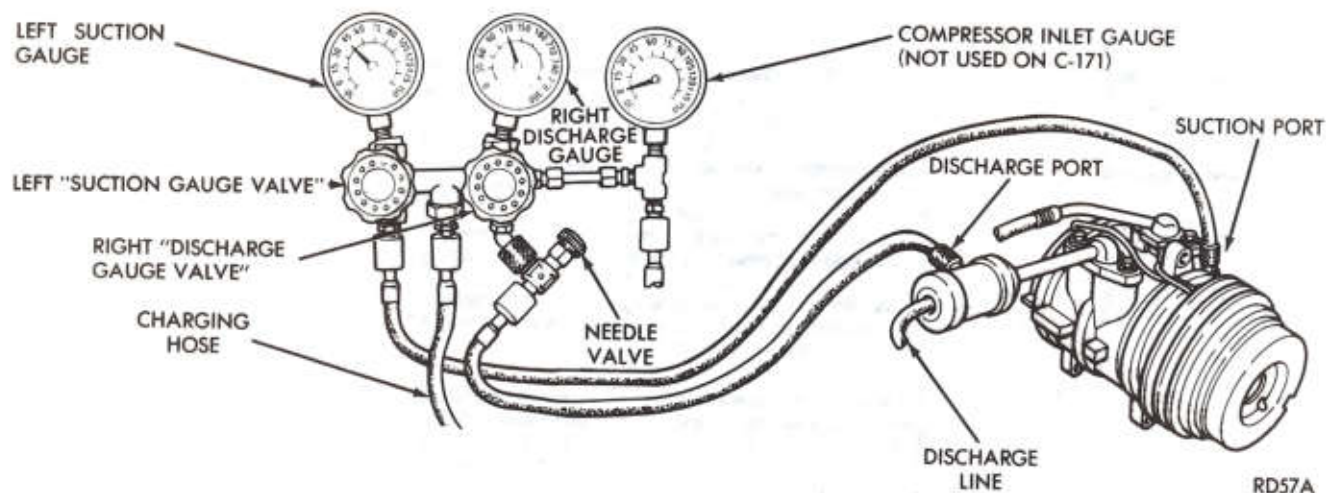


Fig. 5—Typical Manifold Gauge Set Installation

specifications in the performance temperature chart, refer to the diagnostic analysis charts for further test information.

EXPANSION VALVE (H-TYPE) TEST WITH C-171 COMPRESSOR

Test must be made at ambient temperature of 70° to 85°F (21°C to 29°C).

After performing all previously mentioned tests, conduct the H-valve test as follows:

(1) **A/C System**—Close the windows and operate the engine at 1000 rpm. Set air conditioning controls for Max. A/C, high blower, temperature control lever in full reheat position and cycling clutch switch electrically bypassed. Disconnect and plug the water valve vacuum hose in the engine compartment.

(2) Operate the system for at least (5) minutes in order to obtain partial stabilization and sufficient reheat to load the system. Pressure at the discharge service port should reach 140-240 psig (966 to 1656

kPag) (Fig. 6). If head pressure of 140-240 psig (966 to 1656 kPag) cannot be obtained, check system charge level (see system charging section).

(3) Extreme care should be taken in handling freon (see safety precaution section). Spray the H-valve control head (Fig. 7) with liquid freon (refrigerant) for 10 to 15 seconds. The evaporator suction pressure must drop to below 15" of vacuum (−50 kPag). If the condition is not met, the H-valve is stuck open and should be replaced. Discontinue spraying with freon and watch the evaporator suction pressure; it should increase to a minimum of 38 psig (262 kPag) and then stabilize to a pressure of 25 to 35 psig (172 to 240 kPag). Any H-valve which does not produce this response is stuck closed and should be replaced.

Alternate Method—Put crushed dry ice on control head (completely cover head) for a minimum of 30 seconds.

WARNING: EXTREME CARE MUST BE USED WHEN HANDLING DRY ICE AS SKIN INJURY CAN OCCUR IF PROTECTIVE GLOVES ARE NOT WORN.

Evaporator suction pressure must drop to below 15" of

PERFORMANCE TEMPERATURE CHART

Garage Ambient Temperature	70°F (21°C)	80°F (26.5°C)	90°F (32°C)	100°F (37.5°C)	110°F (43°C)
Discharge Air Temperature	38-50°F (3-10°C)	42-54°F (6-12°C)	46-58°F (8-14°C)	50-62°F (10-17°C)	54-66°F (12-19°C)
Compressor Discharge Pressure	120 195 psig	160 235 psig	200 270 psig	240 305 psig	280 340 psig
	827 1344 KPag	1103 1620 KPag	1379 1861 KPag	1655 2103 KPag	1379 2344 KPag
Evaporator Suction Pressure	18 30 psig	20 35 psig	22 39 psig	25 43 psig	26 47 psig
	124 207 KPag	138 241 KPag	152 269 KPag	172 296 KPag	179 324 KPag

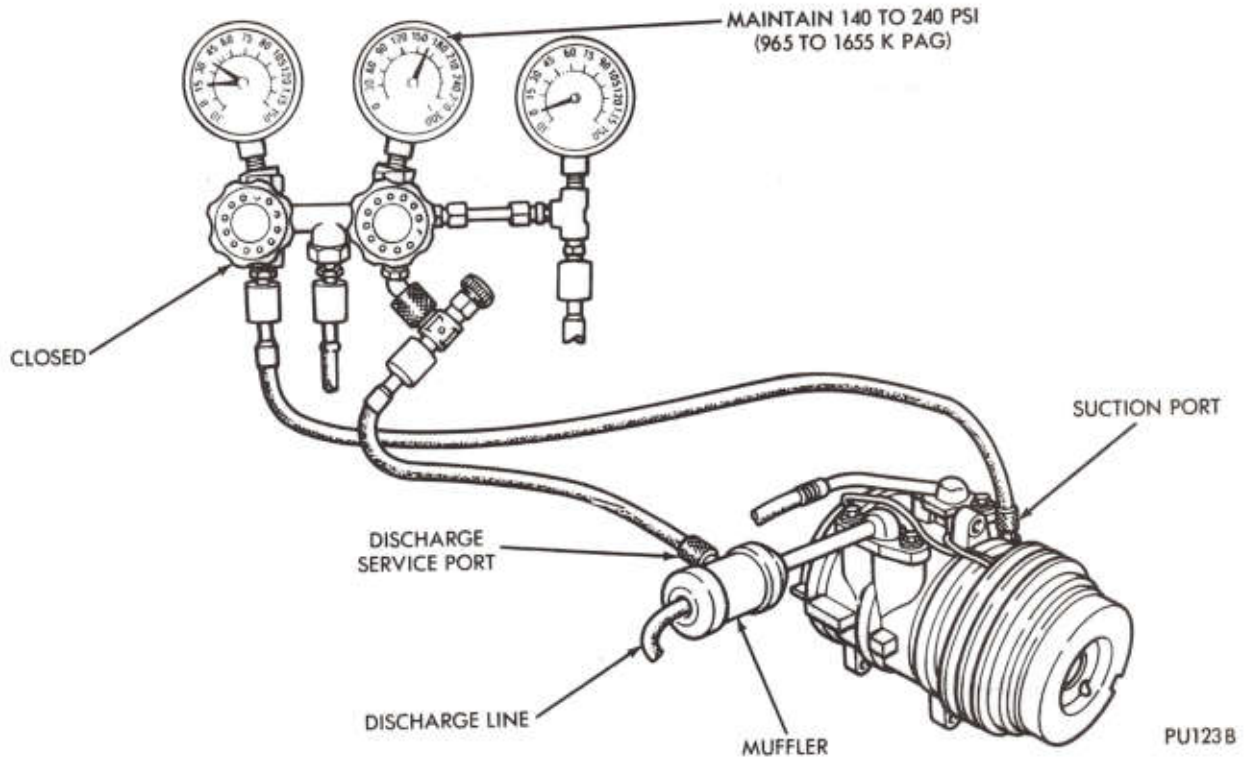


Fig. 6—Expansion Valve (H-Valve) Test

vacuum (-50 kPag). If the condition is not met the H-valve is stuck open and should be replaced. Remove dry ice and watch evaporator suction pressure; it should increase to a minimum of 38 psig (262 kPag) and then stabilize to a pressure of 25 to 35 psig (172 to 240 kPag). Any H-valve which does not produce this response is stuck open and should be replaced.

(4) Reconnect A/C water valve vacuum hose (gray) and set temperature control in cool position.

(5) Set engine speed at 1000 rpm and blower on Hi. The evaporator suction pressure should be in the range of 20-30 psig (138 to 207 kPag). If compressor discharge is higher than 240 psig (1656 kPag), check for restricted discharge line, radiator overheating, air in system or faulty viscous fan drive. If discharge pressure is less than 140 psig (966 kPag), check compressor head gaskets and discharge reeds.

(6) Reconnect the electrical wires to the cycling clutch switch.

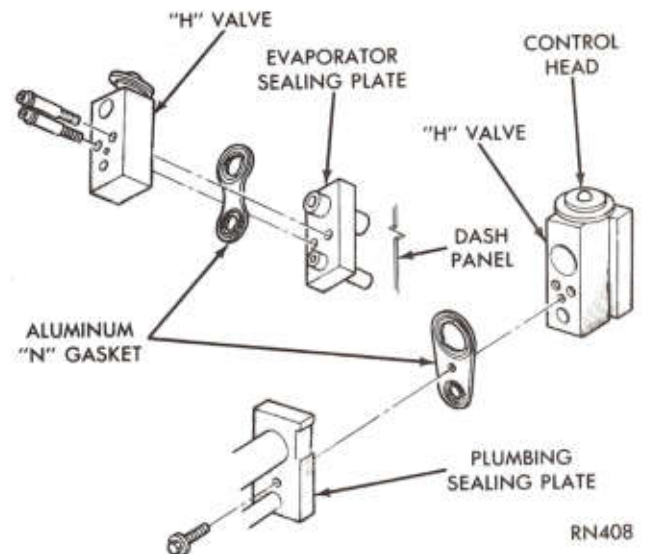
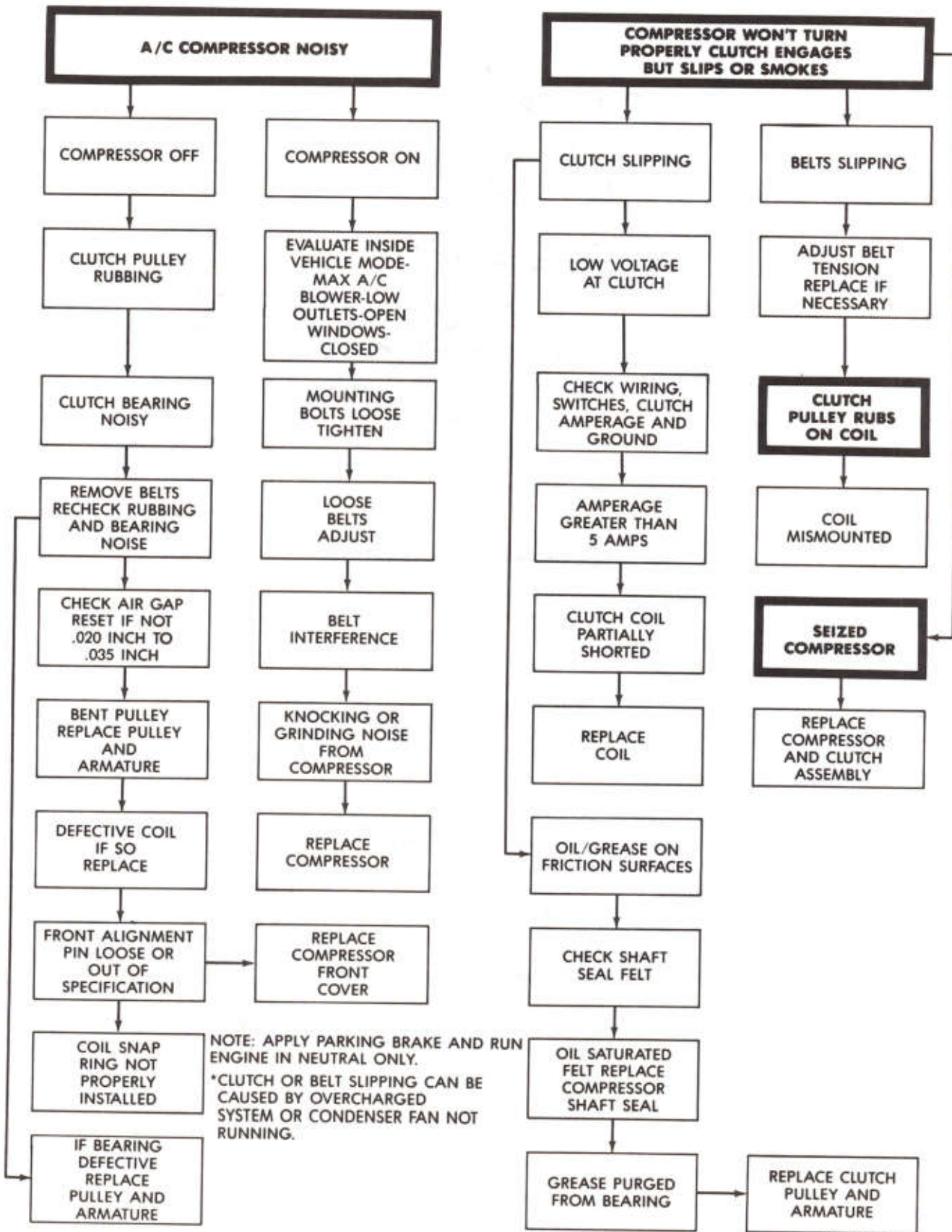
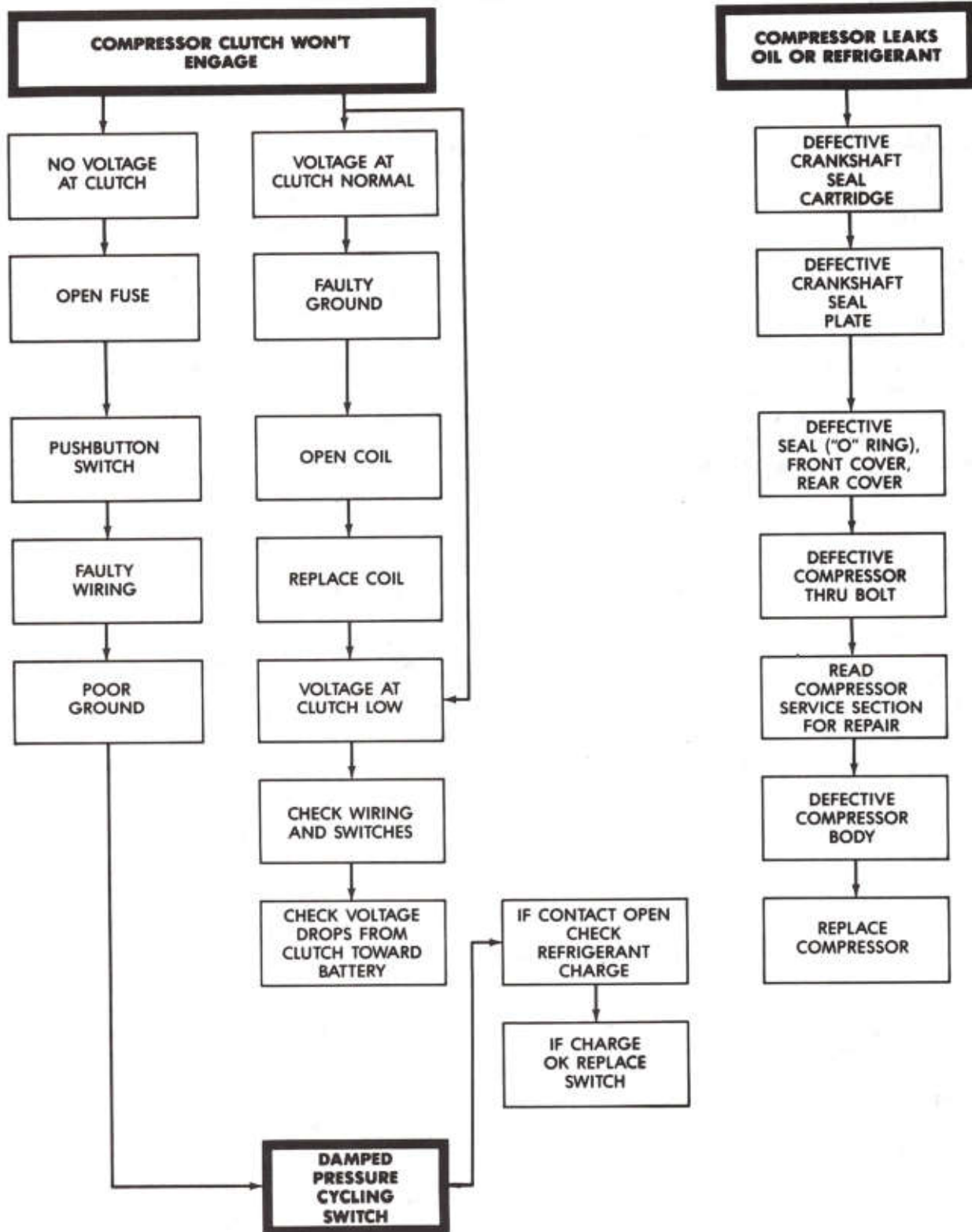


Fig. 7—H-Valve Assembly

COMPRESSOR AND CLUTCH DIAGNOSIS



COMPRESSOR AND CLUTCH DIAGNOSIS



NOTE: APPLY PARKING BRAKE AND RUN ENGINE IN NEUTRAL ONLY.

REFRIGERANT SYSTEM SERVICE PROCEDURES

INDEX

Charging the System	Page 24	Evacuating the System	Page 23
Correcting Low Refrigerant Levels	22	Refrigerant Leak Repair Procedure	22
Discharging the System	23		

REFRIGERANT LEAK REPAIR PROCEDURE

Lost Charge

If the system has lost all charge due to a leak:

- (1) Evacuate the system.
- (2) Charge the system with approximately one pound of refrigerant.
- (3) Locate all leaks.
- (4) Repair all leaks.
- (5) Replace filter-drier bottle.

CAUTION: Replacement filter-drier units must be sealed while in storage. The drier used in these units absorbs and traps moisture quickly upon exposure to the atmosphere. When installing a drier, have all tools and supplies ready for quick reassembly to avoid keeping the system open any longer than necessary.

- (6) Check system oil level (see test procedure).
- (7) Evacuate and charge the system.

Low Charge

If the system has not lost all of its refrigerant charge; locate and repair all leaks. If it is necessary to increase the system pressure to find the leak (because of an especially low charge), add 1/2 lb (230 g) of refrigerant. If there has been a significant oil loss, check the system oil level. If it has been possible to repair the leak without discharging the refrigerant system and if an oil level check was not necessary, use the procedure for correcting low refrigerant level.

CORRECTING LOW REFRIGERANT LEVEL

Since the refrigeration system is completely sealed, the refrigerant level will not be low unless there is a leak in the system.

Before adding refrigerant where the cause of a low level is not known, the system should be tested for leaks. Assuming that leaks have been corrected without discharging the system, proceed with partial charge.

Install and connect manifold gauge set (Fig. 1).

- (1) Close both manifold gauge set valves. Open manifold gauge set needle valve.
- (2) Connect the suction gauge test hose to the suction service port of the compressor. Connect the discharge gauge test hose to the discharge service port.
- (3) Connect one end of long test hose to the center

manifold outlet, and other end to refrigerant dispensing manifold.

- (4) Close two dispensing manifold valves and open remaining dispensing manifold valve. Remove protective cap from opened valve.

WARNING: NEVER USE THESE CANS TO CHARGE INTO THE HIGH PRESSURE SIDE OF THE SYSTEM (COMPRESSOR DISCHARGE PORT) OR INTO A SYSTEM THAT IS AT HIGH TEMPERATURE, BECAUSE THE HIGH SYSTEM PRESSURES COULD BE TRANSFERRED INTO THE CHARGING CAN CAUSING IT TO EXPLODE.

- (5) Screw a can of R-12 to the opened manifold valve. Be sure gasket is in place and in good condition. Tighten refrigerant can and manifold locking nut to insure a good seal. Do not overtighten since 6 to 8 foot-pounds (8 to 11 N·m) is sufficient if gasket is in good condition.

- (6) Turn manifold valve (above the refrigerant can) completely clockwise to puncture the can. This closes the valve and seals the refrigerant in the can.

CAUTION: Do not heat refrigerant 12 above 125°F (52°C).

- (7) Place refrigerant can in a large pan of water heated to 125 degrees F (52°C). Place pan of water containing the refrigerant can on an accurate scale so the amount of refrigerant added can be weighed. Open the refrigerant manifold valve.

- (8) Purge all air from test hoses. Air in the system will be trapped in the condenser causing abnormally high discharge pressures and interfering with condensing of the refrigerant.

- (a) Loosen both test hoses at the manifold gauge set. Tighten the hoses as soon as the air is purged.

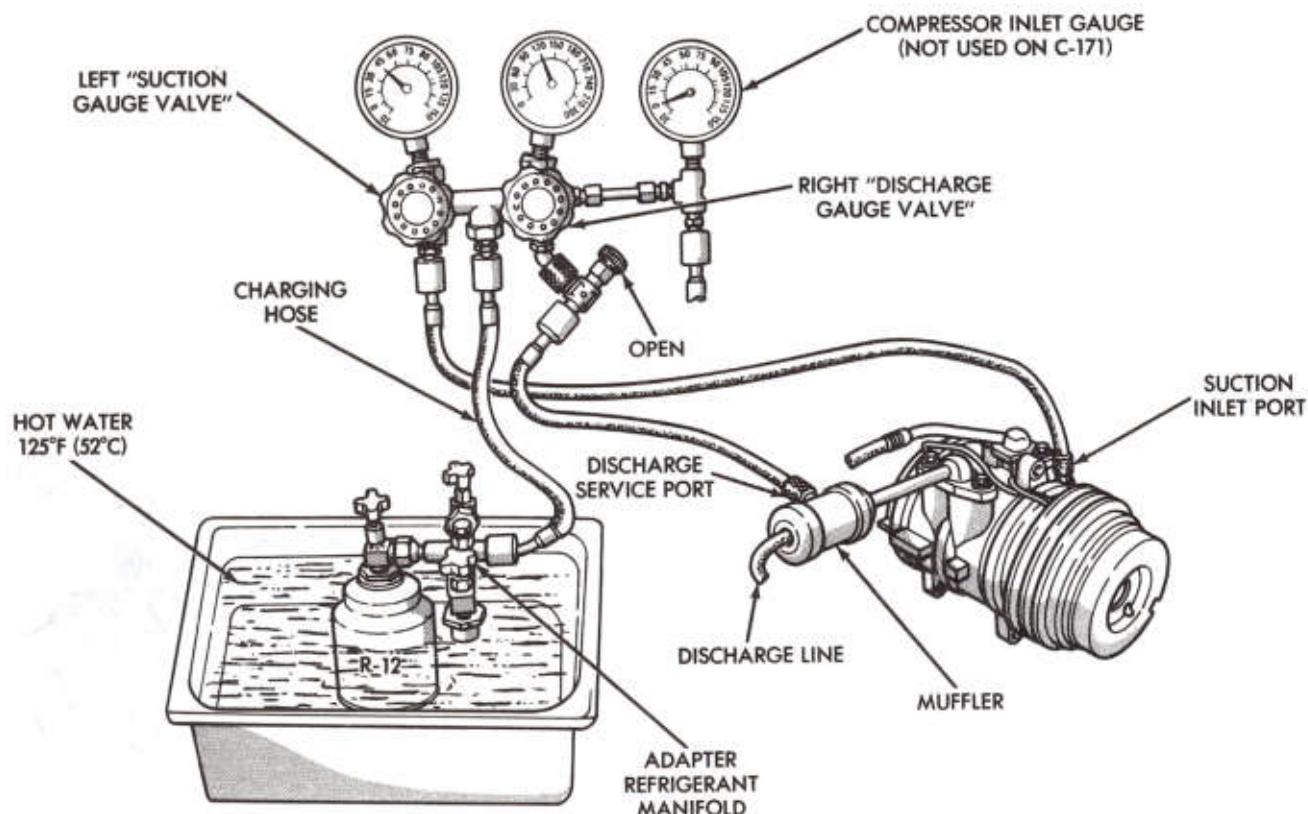
- (b) Loosen charging hose connection at manifold gauge set. This will purge air from the charging hose. Tighten connection as soon as air is purged.

- (9) With vehicle windows open and hood up, operate engine at 1300 rpm.

- (10) Place air conditioner control on A/C and place the fan switch on high.

- (11) If necessary, block the condenser to maintain a discharge pressure of 225 to 250 psig (1550 to 1725 kPag). System must be charged through the evaporator suction service ports as follows:

- (a) Slowly open the suction service gauge valve. Meter flow of refrigerant by adjusting the suction



PU124A

Fig. 1—Adding Partial Charge

service gauge valve so the pressure registered at the suction service gauge does not exceed 50 psig (345 kPag). Keep refrigerant container upright.

(b) Add refrigerant gas until there is no foam visible at the sight glass. As soon as all foam clears, note the weight registered on the refrigerant scale.

(c) Watch the refrigerant weighing scale and add 14 oz. (437 g) of refrigerant (equivalent to one can).

Close the suction gauge valve.

CAUTION: Too much refrigerant in the system can cause abnormally high discharge pressures. Care must be used so the exact recommended amount of refrigerant is added after foam clears in the sight glass.

(d) Close dispensing manifold valve. Remove test hoses and adapters from the service ports of compressor, and install protective caps at service ports.

DISCHARGING THE SYSTEM

Since the air conditioning refrigerant system is pressurized, it will be necessary to completely discharge the system before replacing any refrigerant components. The procedure is as follows:

(1) Install gauge set as described under manifold gauge set installation. Make sure the gauge set valves are closed before attaching the hoses to the refrigerant system.

(2) Install a long hose to the manifold gauge set connector. Run this hose to the oil collector can near the shop exhaust system (Fig. 2).

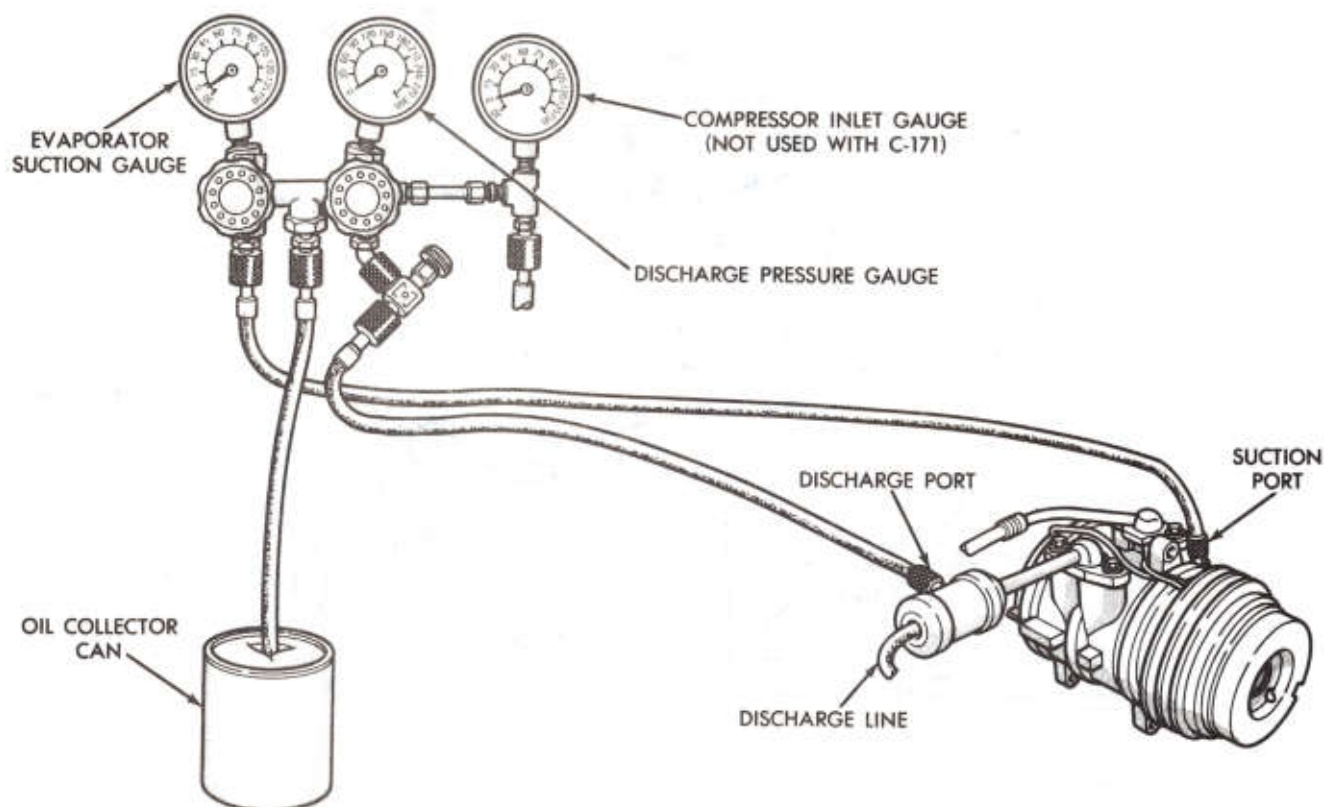
A good oil collector can may be made from a large empty coffee can with a plastic top. Slit the plastic top in the form of a Y to make an entrance for the refrigerant hose and an exit for the gas.

(3) Open the compressor discharge and suction line pressure valves and discharge the refrigerant into the oil collector can. Watch to make sure the hose does not blow out of the collector can.

(4) When the system has been completely discharged, measure the amount of oil collected in the can. The amount of oil measured should be added to the refrigerant system before it is re-charged. Add new oil—discard the used oil.

EVACUATING THE SYSTEM

Whenever the system has been opened to the atmosphere, it is absolutely essential that the system be evacuated or "vacuumed" to remove all the air and moisture. Air in the refrigerant system causes high compressor discharge pressures, a loss in system performance, and oxidation of the compressor oil into gum and varnish. Moisture in the refrigerant system can cause the expansion valve to malfunction. Under certain conditions it can react with the refrigerant to



RY302

Fig. 2—Discharging the System

form destructive acids. It is necessary to adhere to the following procedure to keep air and moisture out of the system.

(1) Connect the manifold gauge set to the compressor and a long test hose from manifold gauge set center connection to vacuum pump, Tool C-4081, or C-4289, as shown in Figure 3.

(2) Open both manifold gauge set valves.

(3) Start the vacuum pump and operate until the evaporator suction gauge registers at least 26 inches of vacuum (-88 kPag).

If at least 26 inches of vacuum (-88 kPag) cannot be obtained, either the system has a leak or the vacuum pump is defective. Check the vacuum pump. If the pump proves to be functioning properly, the system has a leak. Charge the system with one pound of refrigerant. Locate and repair all leaks. Discharge the refrigerant and evacuate the system.

(4) Continue to operate the pump for at least five minutes.

(5) Close manifold valves. Turn off the vacuum pump and observe evaporator suction gauge for two minutes. The vacuum level should remain constant.

If the vacuum level falls off, the system has a leak. Charge the system with 1 pound (450 g) of refrigerant. Locate and repair all leaks. Discharge the system and repeat evacuation procedure.

CHARGING THE SYSTEM

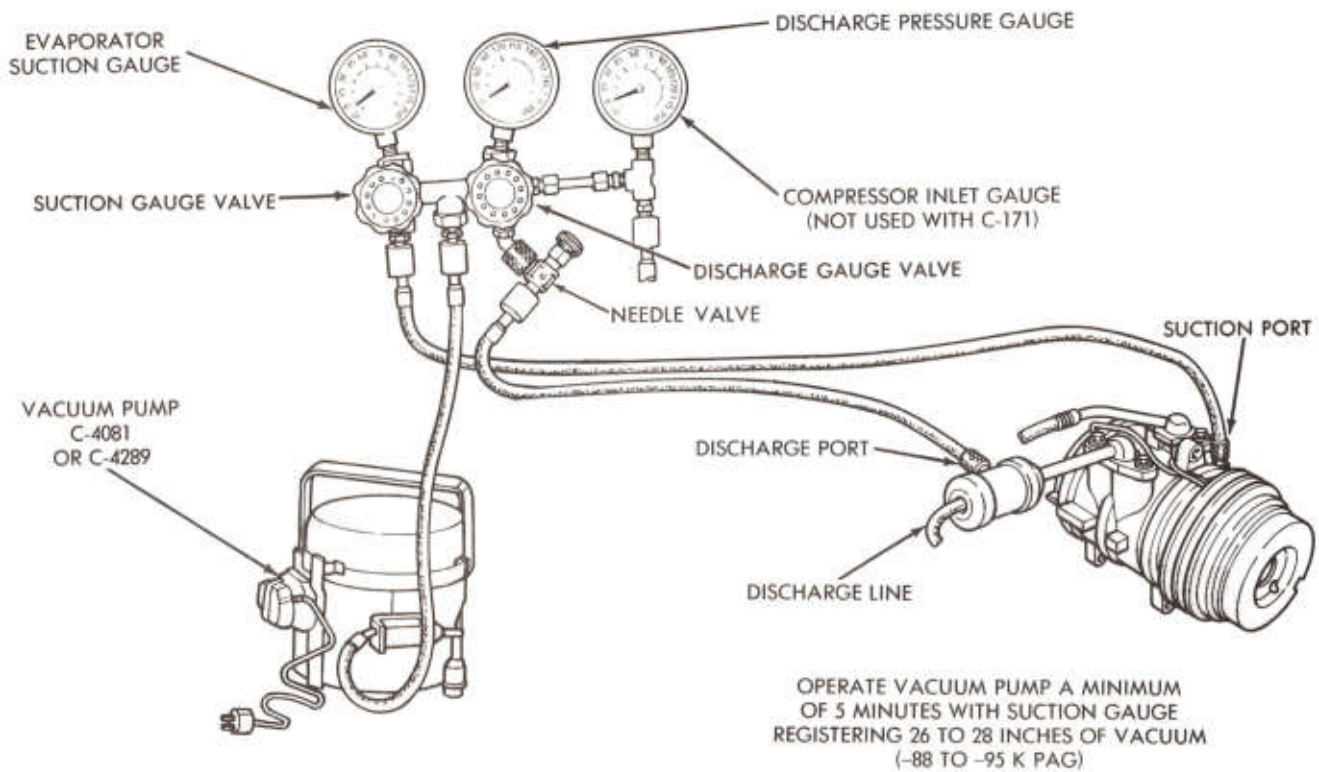
The refrigerant system must have been evacuated using the previous procedure before charging. Charge using only R-12 refrigerant. R-12 is available in bulk tanks or 14 ounce (437 g) cans. Follow the safety precautions for handling R-12 as listed under air conditioning.

Charging with 14 Ounce (437g) Cans

The special refrigerant dispensing manifold permits charging three cans of refrigerant at one time. When using disposable cans of this type, carefully follow the can manufacturers instructions.

WARNING: NEVER USE THESE CANS TO CHARGE INTO THE HIGH PRESSURE SIDE OF THE SYSTEM (COMPRESSOR DISCHARGE PORT) OR INTO A SYSTEM THAT IS AT HIGH TEMPERATURE, BECAUSE THE HIGH SYSTEM PRESSURES COULD BE TRANSFERRED INTO THE CHARGING CAN CAUSING IT TO EXPLODE.

Keep the refrigerant manifold valves capped when not in use. Keep a supply of extra refrigerant-can-to-refrigerant-manifold gaskets on hand so the gaskets can be replaced periodically. This will insure a good seal without excessive tightening of the can or the manifold nuts.



PU125C

Fig. 3—Evacuating the System

(1) Attach center hose from manifold gauge set to refrigerant dispensing manifold. Turn refrigerant manifold valves completely counterclockwise so they are fully open. Remove protective caps from refrigerant manifold.

(2) Screw refrigerant cans into manifold. Be sure manifold-to-can gasket is in place and in good condition. Tighten can and manifold nuts to 6 to 8 foot-pounds (8 to 11 N·m).

(3) Turn three refrigerant manifold valves completely clockwise to puncture the cans and close the manifold valves (Fig. 4).

(4) Purge the air from the charging line by loosening the charging hose at the manifold gauge set and turning one of the refrigerant valves counterclockwise to release refrigerant. When the refrigerant gas starts escaping from the loose connection, re-tighten the hose.

CAUTION: Do not heat refrigerant 12 above 125°F (52°C).

(5) Fully open all three refrigerant manifold valves and place the cans of refrigerant into a pan containing 125°F (52°C) water. The water will warm the

charging can and aid in the transfer of the charge into the system.

(6) Start the engine and move the controls to A/C low blower position.

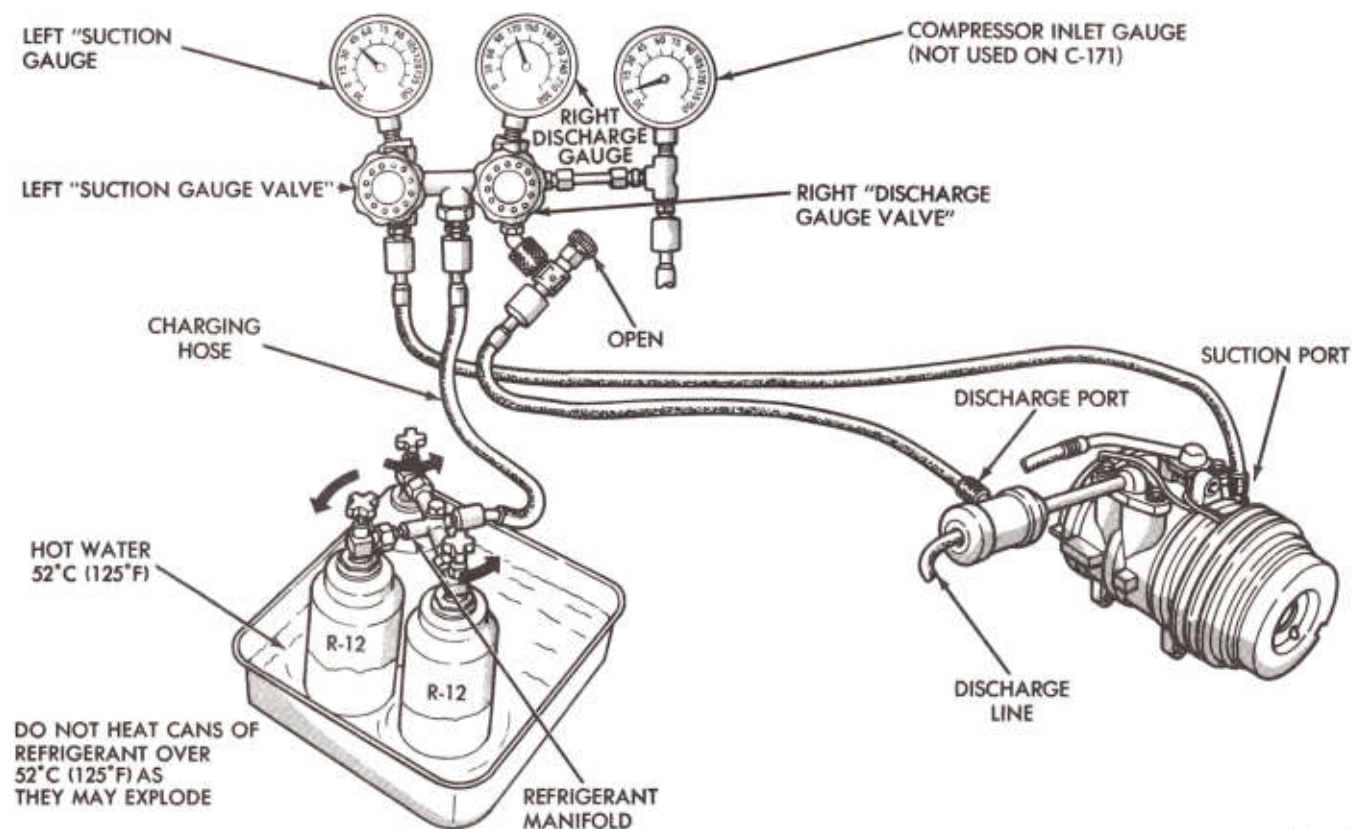
The damped pressure cycling switch will prevent the clutch from engaging until refrigerant is added to the system. If the clutch does engage, replace the switch before proceeding any further.

(7) Charge through the suction side of the system by slowly opening the suction manifold valve. Adjust the valve as necessary so charging pressure does not exceed 50 psig (345 kPag). Maintain the temperature of the water in the pan by adding warm water as necessary.

(8) Adjust the engine speed to a fast idle of approximately 1300 rpm.

(9) When all three cans of refrigerant are completely empty, close the manifold gauge set valves and refrigerant manifold valves.

Refrigerant Charge	
Truck Model	Refrigerant
All	44 oz. max.



PU126B

Fig. 4—Complete Charging of the System

SERVICE PROCEDURES

INDEX

	Page		Page
Compressor Drive Belt Adjustment	27	Condensate Drain Tube	28
Compressor Noise	27	Vacuum Control System Adjustments and Tests	27
Handling Tubing and Fittings	26		

HANDLING TUBING AND FITTINGS

Kinks in the refrigerant tubing or sharp bends in the refrigerant hose lines will greatly reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement of lines or components. The following precautions must be observed.

The system must be completely discharged before opening any fitting or connection in the refrigeration system. Open fittings with caution even after the system has been discharged. If any pressure is noticed as a fitting is loosened, allow trapped pressure to bleed off very slowly. Never attempt to rebend formed lines to fit. Use the correct line for the installation you are repairing.

A good rule for the flexible hose lines is to keep the radius of all bends at least 10 times the diameter of the hose. Sharper bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 3 inches (80 mm) from the exhaust manifold. It is a good practice to inspect all flexible hose lines at least once a year to make sure they are in good condition and properly routed.

Unified plumbing connections with aluminum-N-gaskets cannot be serviced with O-rings. These gaskets are not reusable and do not require lubrication before installing (Fig. 1).

The use of correct wrenches when making connections are very important. Improper wrenches or improper use of wrenches can damage the fittings.

The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure-moisture-free Refrigerant 12 and refrigerant oil is used. Abnormal amounts of dirt, moisture or air can

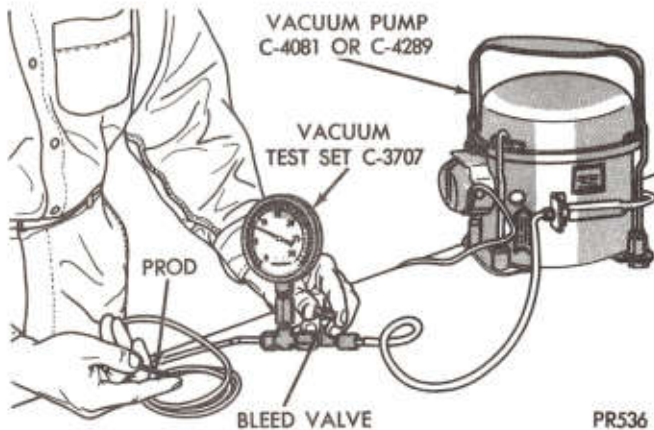


Fig. 1—Adjust Vacuum Test Bleed Valve

upset the chemical stability and cause operational troubles or even serious damage is present in more than minute quantities.

When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture. All lines and components in parts stock should be capped or sealed until they are ready to be used.

All tools, including the refrigerant dispensing manifold, the manifold gauge set and test hoses should be kept clean and dry.

COMPRESSOR DRIVE BELT ADJUSTMENT

Satisfactory performance of the air-conditioning system is dependent upon drive belt condition and tension. If the proper tensions are not maintained, belt slippage will greatly reduce air-conditioning performance and drive belt life. To avoid such adverse effects, the following service procedure should be followed:

- (1) Any belt that has operated for a minimum of one half-hour is considered to be a used belt. Adjust air-conditioning drive belts at the time of new-vehicle preparation. See Chart, "Accessory Belt Drives," "Group 7, Cooling."
- (2) Measure drive belt tension at regular service intervals using a belt tension gauge or torque method, and adjust as needed.
- (3) On all new-belt installations, new-belt tension specifications should be used when the belt is first installed to obtain proper tension. Thereafter, these replacement belts should be serviced according to the above procedure. Always replace belts in pairs if so equipped, otherwise the old belt will have insufficient tension and the load will be primarily on the new belt. See Chart, "Accessory Belt Drives," "Group 7, Cooling."

COMPRESSOR NOISE

Noises that develop during air-conditioning operation can often be misleading. For example: what sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose clutch assembly. Improper belt tension is also often the source of an objectionable noise and can easily be mistaken for internal compressor troubles.

Drive belts are speed sensitive. That is, at different engine speeds, and depending upon belt tension, belts can develop unusual noises that are often mistaken for mechanical problems within the compressor.

Adjustment Procedures

- (1) Select a quiet area for testing. Switch compressor on and off several times to clearly identify compressor noise.
- (2) Tighten all compressor mounting bolts, clutch mounting bolt, clutch coil mounting screws and compressor drive belts. Check that plumbing is not rubbing other parts.
- (3) Make sure that matched drive belts are equally tensioned. Replace any parts that are defective or missing.
- (4) Re-test vehicle; if noise persists, continue trouble shooting system for source of noise.

VACUUM CONTROL SYSTEM ADJUSTMENTS AND TESTS

To keep the vacuum harness in place, common vinyl tape (sometimes called plastic tape or electrician's tape) cannot be used as it will cause the tube to deteriorate directly under the tape, when high underhood temperatures are involved. A compatible nylon type of tape such as MS CH69, (#281) available from Kendall Company, or an equivalent must be used.

The test of the push button switch operation determines whether or not the vacuum and electrical circuits are properly connected and the controls are functioning properly. However, it is possible that a vacuum control system that operates perfectly during high manifold vacuum provided at engine idle may not function properly at high engine speeds. Before starting this test, stop engine and make certain the vacuum source hose at engine intake manifold is tight on its connector.

Start vacuum pump Tool C-4081, or C-4289, and connect the vacuum test set Tool C-3707. Adjust bleed valve on test set to obtain a vacuum reading of exactly 8 inches of mercury (-27 kPag) with a finger blocking the prod on end of test hose (Fig. 1).

It is essential that the bleed valve be adjusted so the vacuum gauge pointer will return to exactly 8 inches (-27 kPag) when the prod is covered by a finger. Otherwise a false reading will be obtained when the

control circuit is tested.

Alternately release and reblock the hose prod several times. Make sure the bleed valve is adjusted so the vacuum gauge pointer returns to exactly 8 inches of vacuum (-27 kPag) when the prod is covered with a finger (Fig. 1).

Disconnect engine vacuum source hose at engine intake manifold and insert vacuum tester hose prod into source hose leading to push button switch. Place vacuum gauge on the cowl so it can be observed from the driver's position as push buttons are operated.

Start the test by depressing the control "Heat" mode pushbutton. Vacuum tester gauge needle will drop until the actuator has operated, and should then return to 7-1/4 to 8 inches (-25 to -27 kPag) depending on vacuum leakage. Continue to depress; "Off," "Max. A/C," "A/C," "Vent," "Defrost," and "Heat" mode pushbutton allowing time for actuators to operate after each button is pushed, and for the vacuum to stabilize. Note the vacuum drop below 8 inches (-27 kPag) after each operation. The maximum allowable vacuum drop below 8 inches (-27 kPag) after each operation is 3/4 inch (-3 kPag). (Bypass the vacuum storage tank if so equipped).

If the vacuum drop is more than 3/4 inch (-3 kPag), first recheck the tester for reading exactly 8 inches (-27 kPag). If correct, inspect the fit of the 7-port hose connector plug on the push button switch. This plug must be positioned all the way onto the 7 ports on the push button switch.

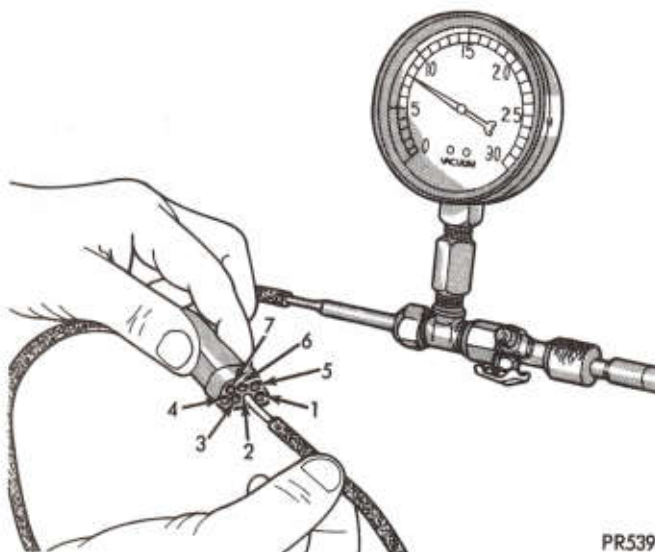
CAUTION: Do not use lubricant on the switch ports or in the holes in the plug, as lubricant will damage the vacuum valve in the switch. If it is difficult to properly position the connector plug all the way on the switch ports, put a drop or two of clean water in the holes of the connector plug. This will allow the plug to slide completely on the switch ports.

If vacuum drop is now within limits, proceed with the over-all performance test. If vacuum drop is still in excess of 3/4 inch (-3 kPag), remove 7 port connector from switch and seal port No. 6 with a finger to check source hose. Then remove prod from source line and insert it alternately into each connector port except No. 6 (Fig. 2).

Note amount of vacuum drop below 8 inches (-27 kPag) after each actuator has operated. If vacuum test gauge comes back to 8 inches (-27 kPag) at each of the 7 ports, the hoses and actuators are not leaking. The control switch is faulty and must be replaced. If excessive vacuum drop shows up at one or more ports in connector block, isolate faulty hose or actuator.

Inspect hose connections to the actuator involved. Then test whether actuator or hose is at fault; use the test hose on the actuator involved (Fig. 3).

A leak in a hose may be detected with vacuum test set by running the fingers along the hose and watching vacuum gauge reading. The tube can be repaired

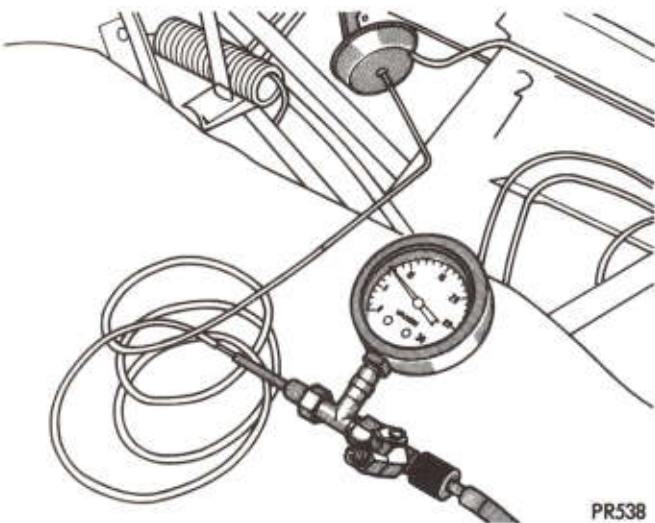


PR539

Fig. 2—Vacuum Tube Assembly Test

by cutting out the "leak" and inserting the tube "ends" into a 1/8 inch (3 mm) inside diameter rubber tube. Wet the tube with water to aid assembly.

A vacuum drop in excess of 3/4 inch (-3 kPag) below the 8 inches (-27 kPag) needed in this test will not interfere with the engine operation, other than perhaps to cause a rough idle. It can, however, interfere with the proper operation of the air-conditioning and heating controls at high speeds and during acceleration.



PR538

Fig. 3—Vacuum Actuator Test

CONDENSATE DRAIN TUBE

Condensation which accumulates on the bottom of the evaporator housing is expelled through the molded rubber drain tube into the engine compartment. The tube must be kept open to prevent condensation from collecting in the bottom of the housing.

The squeezed rubber flap at the drain tube tip is designed to keep engine compartment air from entering into the system yet allow condensate drainage. If

the tip is not properly formed or has been damaged, the system will not drain properly. Therefore, if the tube is damaged, it should be replaced.

COMPRESSOR SERVICE

INDEX

	Page		Page
A/C Clutch	29	Disassembly	33
Voltage and Current Draw	29	Assembly	35
Removal	30	General Information	29
Installation All	30	Oil Level	36
Compressor	32	Servicing the C-171 Compressor	29

GENERAL INFORMATION

The C-171 is a six cylinder, axial type compressor. The pistons are reciprocated by a swash plate fastened to the drive shaft. When the clutch is energized, the compressor clutch rotates and drives the six pistons in sequence. The electromagnetic clutch is built into the drive pulley assembly (Fig. 1).

The electromagnetic field coil, that does not rotate, is fastened directly to the compressor with a snap ring. The positive lead wire is connected to the engine wiring harness and the ground lead is attached to the compressor housing.

SERVICING THE C-171 COMPRESSOR

The following precautions should be observed when servicing the C-171 compressor.

- (1) The A/C refrigerant system must be completely discharged before performing any disassembly or repair service to the compressor.
- (2) Cleanliness is extremely important. The work area must be clean and free of air-borne dust and dirt.
- (3) Use only wax-free, 500 SUS (Saybolt Uniform Seconds) viscosity refrigerant oil. Refrigerant oil must

be kept in a sealed container until ready for use to prevent moisture and dirt from entering. Never use any other oil.

(4) To ensure proper lubrication, the amount of oil used is important. If the compressor is to be removed for repair or replacement, measure the amount of refrigerant oil in the compressor so that the same amount can be added when the new or repaired compressor is installed.

CAUTION: When replacing the compressor assembly, or if at any time it is inadvertently tipped over the crankshaft should be rotated by hand several revolutions to clear oil accumulation from the compressor head before the clutch is energized to avoid damaging the compressor reed valves.

A/C CLUTCH

Clutch Coil Voltage and Current Draw To Test the Coil Circuit

- (1) Verify battery state of charge. (Test indicator should be green.)
- (2) Connect an ammeter (0-10 ampere scale) in series with the clutch coil terminal. Use a voltmeter (0-20 volt scale) with clip leads measuring voltage across the battery and A/C clutch.
- (3) With A/C control in A/C mode and blower at low speed, start the engine and run at normal idle.
- (4) The A/C clutch should engage immediately (carbureted engines) or in 11 seconds after the start (EFI engines). The clutch voltage should be within 2 volts of the battery voltage. If the A/C clutch does not engage, check the fuse (fuselink with front wheel drive vehicles).
- (5) The A/C coil is acceptable, if the current draw is 2.0 to 3.7 amperes at 11.5 to 12.5 volts at clutch coil with room ambient $21^{\circ} \pm 3^{\circ}\text{C}$ ($70^{\circ} \pm 5^{\circ}\text{F}$). Where voltage is more than 12.5 volts, add electrical loads as needed by increasing blower speed and/or switching other electrical accessories on. If coil current reads zero, the coil is open and should be replaced. If the ammeter reading is 4 amperes or more, the coil is

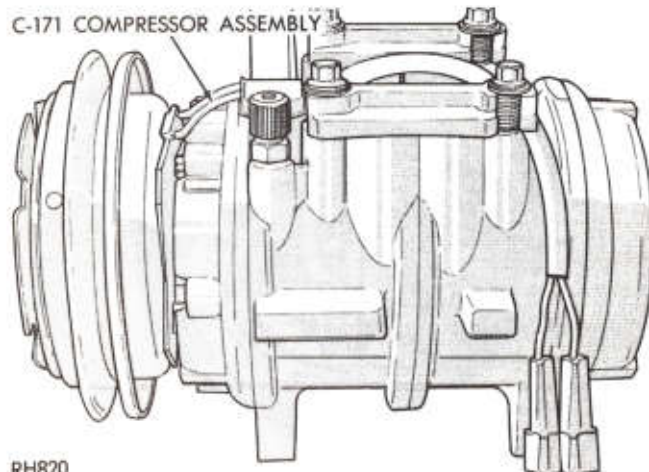


Fig. 1—A/C Clutch Assembly, C-171 Compressor

shorted and should be replaced. If the coil voltage is not within 2 volts of the battery voltage, check the circuit external to the clutch coil for excessive voltage drop and repair accordingly.

Clutch Removal

The procedure for replacing the clutch without discharging the system is as follows:

- (1) Loosen and remove drive belts, and disconnect the field coil lead wire.
- (2) Remove compressor mounting screws.
- (3) Lift compressor up and lay it on the top of the front yoke.
- (4) Using a 13 mm socket and spanner wrench, tool C-4563, remove the shaft nut and then lock washer (Fig. 2).
- (5) Screw clutch front plate puller, Tool C-4771, into hub. Tighten center screw and remove front plate, and shims (Fig. 3).

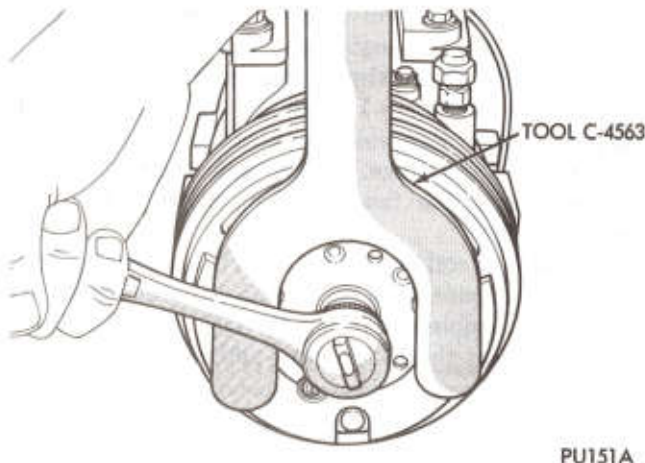
CAUTION: Do not use screwdrivers between front plate assembly and pulley to pry off front plate because this may damage the front plate assembly.

- (6) Remove pulley retaining snap ring with Tool C-4574, and slide pulley assembly off of compressor (Fig. 4).

- (7) Remove snap ring retaining field coil onto compressor housing. After removing screw and wire clip, slide field coil off of housing (Fig. 5).

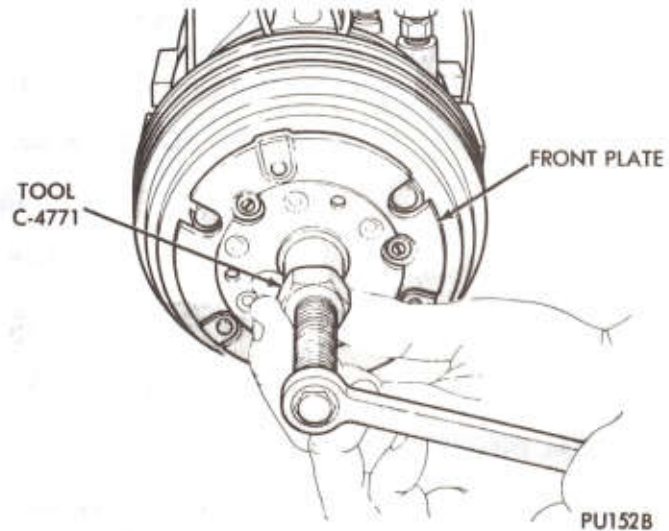
- (8) Examine frictional faces of the clutch pulley and front plate for wear. The pulley and front plate should be replaced if there is excessive wear or scoring. If the friction surfaces are oily, inspect the shaftnose area of the compressor for oil and remove the felt from the front cover. If the compressor felt is saturated with oil, the shaft seal is leaking and will have to be replaced.

- (9) Check bearing for roughness or excessive leakage of grease. If grease from bearing has contaminated the faces of the pulley or front plate or if the



PU151A

Fig. 2—Removing Clutch Retaining Nut, C-171 Compressor



PU152B

Fig. 3—Removing Clutch Front Plate, C-171 Compressor

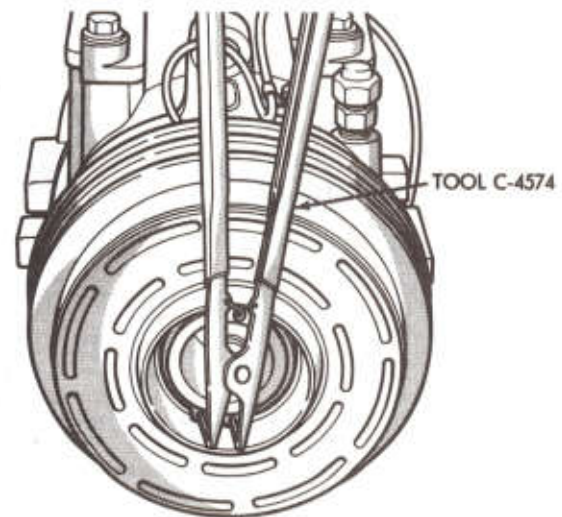
bearing is rough, the clutch pulley and front plate should be replaced.

CAUTION: The clutch pulley and the front plate were mated at the factory by a burnishing operation. No attempt should be made to separately replace either part because it will result in clutch slippage due to insufficient contact area.

Clutch Installation

- (1) Align hole in back of field coil with pin in compressor end housing and position field coil into place (Fig. 6). Make sure that lead wires are properly routed and fasten with the ground wire retaining screw.

- (2) Install field coil retaining snap ring (bevel side outward), with snap ring pliers, Tool C-4574. With a



PU153

Fig. 4—Removing Pulley Snap Ring, C-171 Compressor

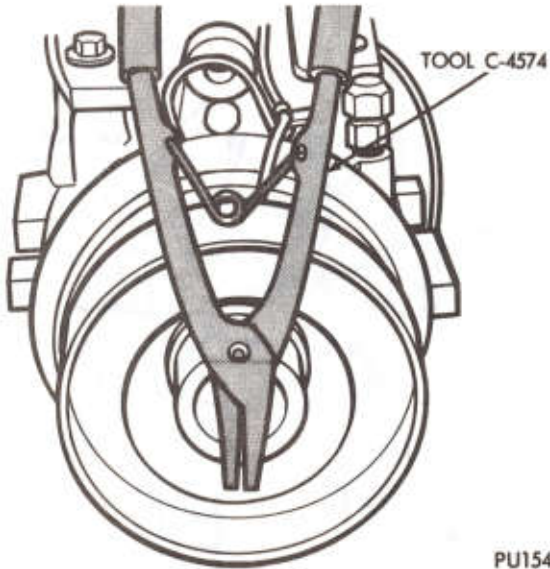


Fig. 5—Removing Clutch Coil, C-171 Compressor

screwdriver, press all the way around snap ring to make sure it is properly seated in the groove.

CAUTION: If snap ring is not fully seated it will vibrate out resulting in a clutch failure and severe damage to the front face of the compressor.

(3) Install pulley assembly onto compressor. If necessary, tap gently with a block of wood on the grease slinger (Fig. 7).

CAUTION: Do not mar the pulley frictional surface and straighten out the grease slinger if it has been distorted by tapping.

(4) Install pulley assembly retaining snap ring, (bevel side outward) with snap ring pliers Tool C-4574. With a screwdriver, press all the way around the snap ring to make sure it is properly seated in the groove.

(5) If the original front plate assembly and pulley assembly are to be reused, the old shims can be used. If not, place a trial stack of shims, .100 in. (2.54mm) thick, on the shaft against the shoulder.

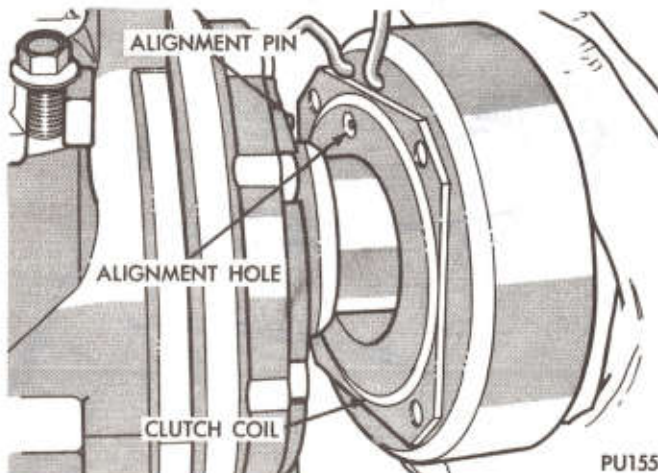


Fig. 6—Installing Clutch Coil, C-171 Compressor

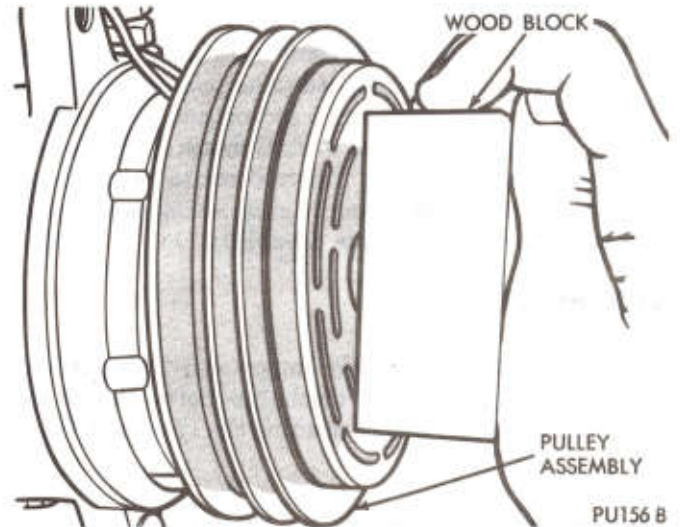


Fig. 7—Installing Pulley Assembly, C-171 Compressor

(6) Install front plate assembly onto shaft making sure the key enters keyway in front plate assembly hub.

(7) With the front plate assembly tight against the shims, measure the air gap between front plate and pulley face with feeler gauges (Fig. 8). The minimum air gap should be between .020 and .035 inch (0.5 and 0.9mm). If proper air gap is not obtained, add or subtract shims until desired air gap is obtained.

(8) Install lockwasher and shaft nut. Tighten to 155 ± 20 in. lbs. (17.5 ± 2 N·m) using torque wrench and spanner wrench tool C-4563.

Shims may compress after tightening shaft nut. Check air gap in four or more places to verify if air gap is still correct. Spin pulley for final check.

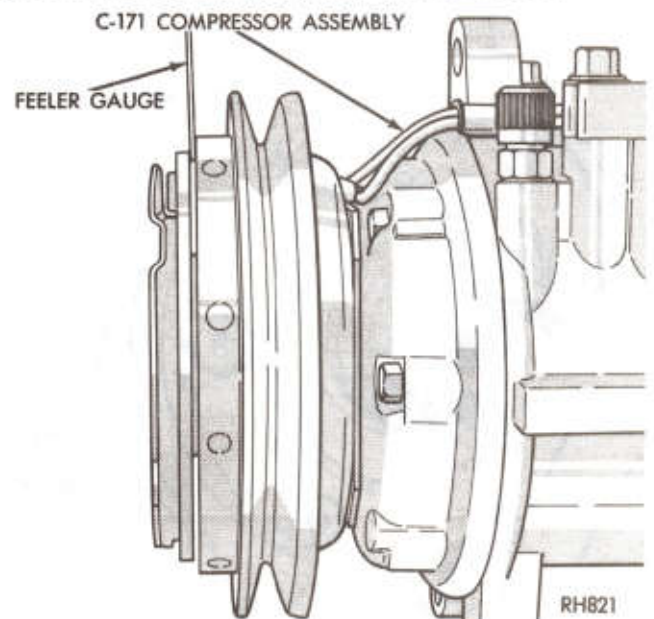


Fig. 8—Measuring Air Gap, C-171 Compressor

Clutch Burnish

After a new clutch has been installed and voltage and amperage are determined to be satisfactory, cycle the clutch at approximately 5 sec. on and 5 sec. off for 20 cycles with the system in A/C mode, high blower, engine rpm at 1500-2000. This procedure (burnishing) will "wear-in" the opposing friction surfaces and provide a higher clutch torque capability.

COMPRESSOR

Cleanliness is extremely important. The surfaces around the suction and discharge ports should be cleaned thoroughly before opening the system at these points.

Compressor Removal

- (1) Discharge the system.
- (2) Disconnect the suction and discharge lines from the suction and discharge ports. Cap the lines and the ports immediately to prevent moisture and dirt from entering the system.
- (3) Disconnect clutch wire.
- (4) Remove the compressor-to-bracket attaching bolts and remove compressor.
- (5) Drain oil from the compressor suction and discharge ports. To service the compressor, it will be necessary to remove the compressor clutch assembly. see "Servicing A/C Clutch".

Disassembly

- (1) Remove key from crankshaft of compressor by gripping with a side cutter and pulling (Fig. 1).

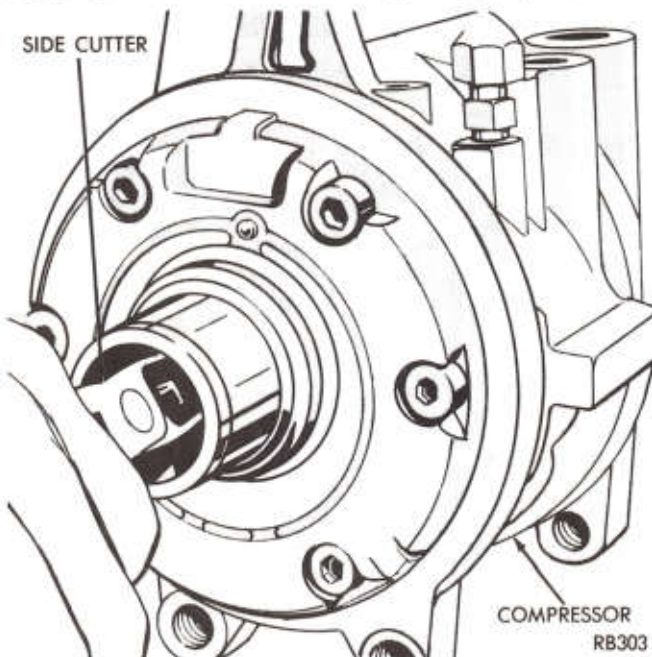


Fig. 1—Crankshaft Key Removal

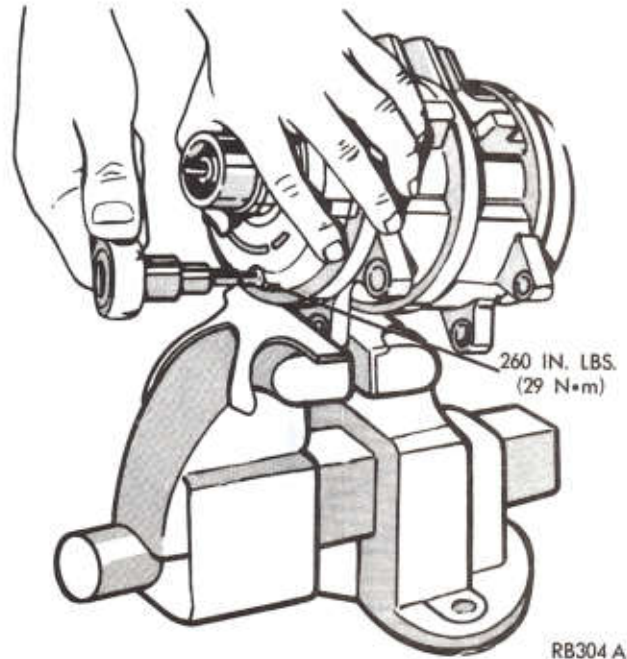


Fig. 2—Removing Compressor thru Bolts

- (2) Remove six (6) compressor thru bolts using a 6 mm allen wrench (Fig. 2).
- (3) Remove front cover by tapping on the outside diameter of the cover with a plastic hammer. (Fig. 3).
- (4) Remove O-ring seal from front cover and discard (Fig. 4). Never re-use cover O-rings or valve plate steel-n-gaskets.
- (5) Remove felt from front cover (Fig. 5).
- (6) Place compressor front cover on a flat surface with neck of cover facing up. Using a brass drift or non-metallic object, press out gas seal plate (Fig. 6).

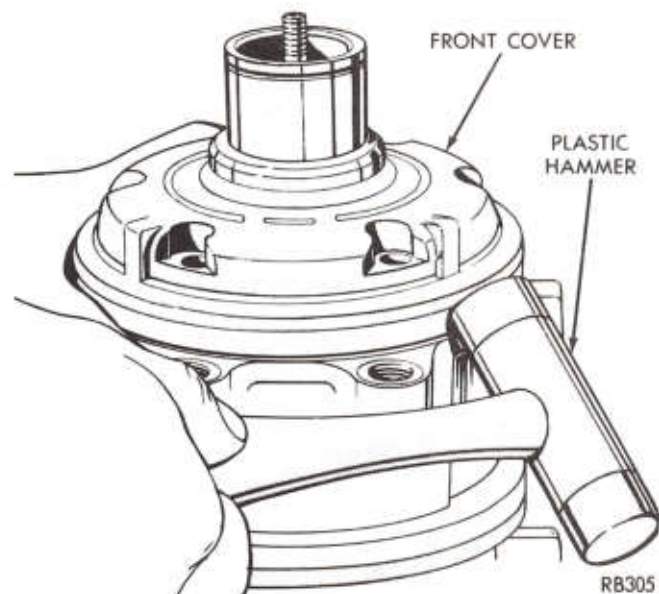


Fig. 3—Removing Front Cover

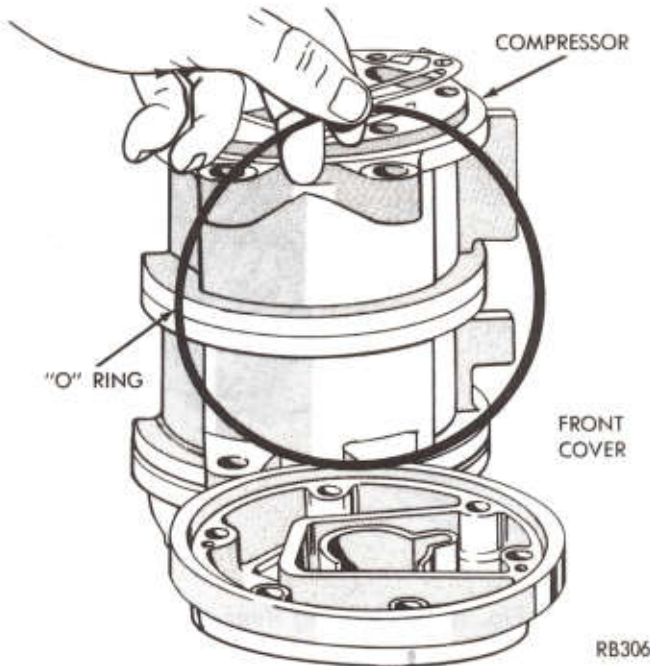


Fig. 4—Removing O-Ring

- (7) Remove shaft seal cartridge from crankshaft (Fig. 7).
- (8) Carefully remove dowel pins, valve plate, suction reed valve, and steel-n-gasket (discard steel-n-gasket). See Figure 8.
- (9) Remove rear cover by tapping the outside diameter of the cover with plastic hammer (Fig. 9).
- (10) Remove O-ring from rear cover and discard (Fig. 10).
- (11) Carefully remove the dowel pins, valve plate,

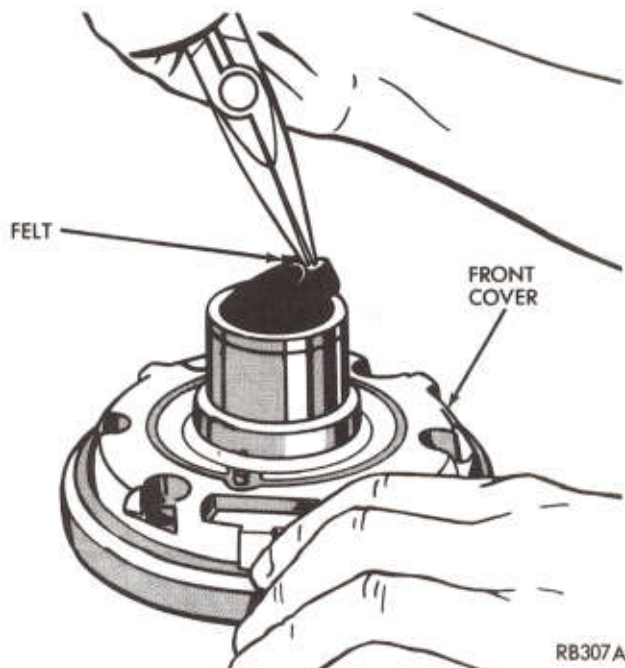


Fig. 5—Removing Felt

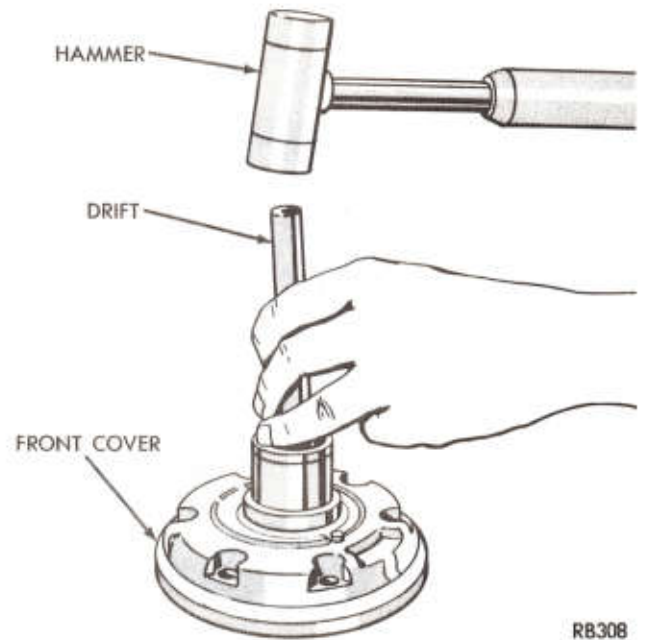


Fig. 6—Removing Gas Seal Plate

suction reed valve, and steel-n-gasket. Discard steel-n-gasket (Fig. 11).

When leak is evident because of compressor body center O-ring, the following procedure should be followed.

- (12) Carefully separate front and rear compressor housings by tapping the body lugs with a plastic hammer (Fig. 12).

CAUTION: Do not separate front and rear housings more than one inch (Fig. 13).

- (13) Remove O-ring and inspect for nicks, cuts, or burrs, if found. Cut and discard.

- (14) Inspect O-ring sealing surface for scratches,

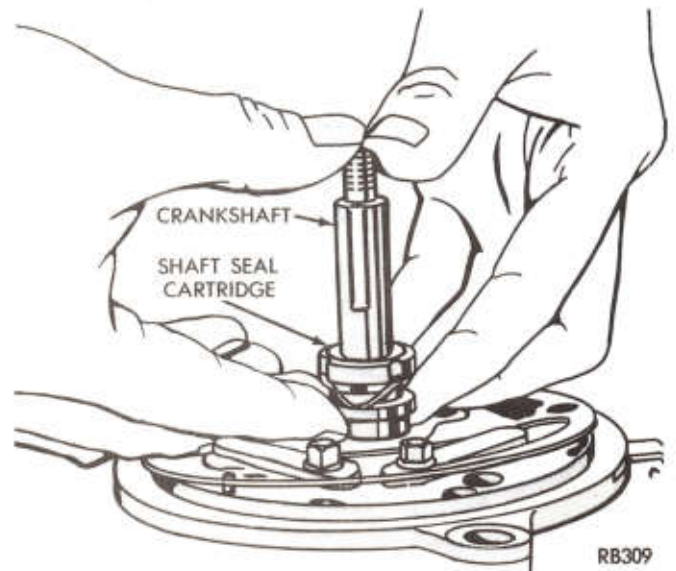


Fig. 7—Removing Shaft Seal Cartridge

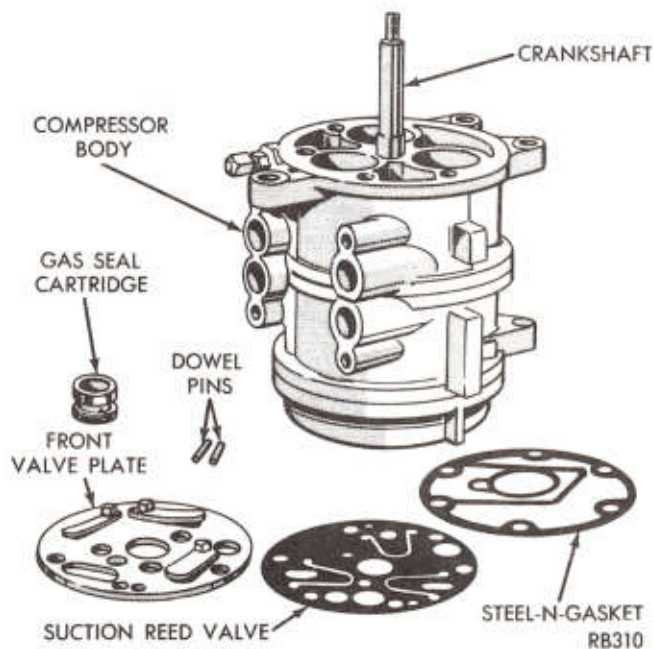


Fig. 8—Disassembling Compressor Front End

(14) Inspect O-ring sealing surface for scratches, dirt, or porosity. If a scratch or porosity is found, compressor should be replaced.

Assembly

(1) Install O-ring by carefully stretching and passing a new, dry O-ring over the rear housing to center of compressor body.

(2) Oil new O-ring with refrigerant oil (500 SUS)

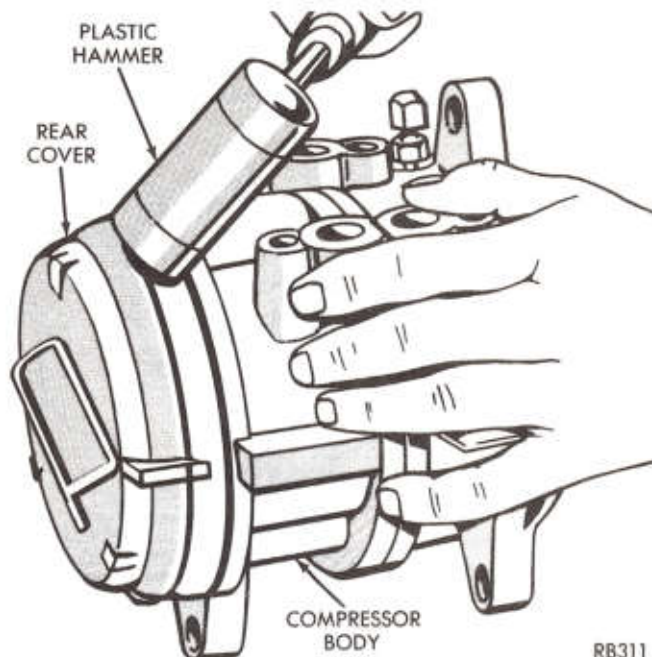


Fig. 9—Removing Rear Cover

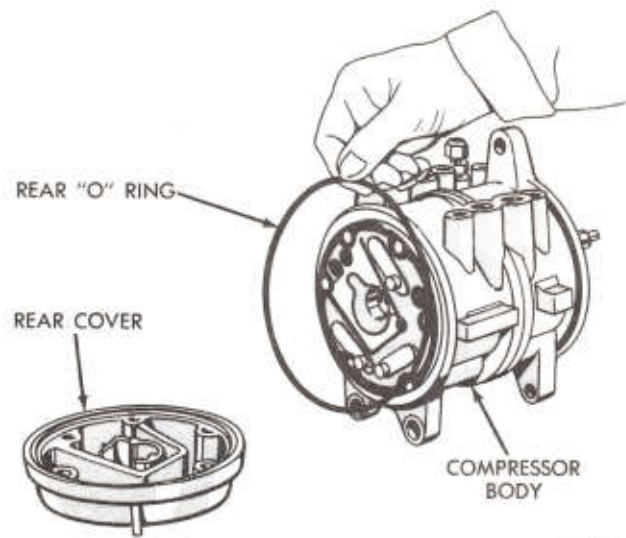


Fig. 10—Removing Rear O-Ring

and position into seal groove.

(3) Mate two body halves by carefully pushing them together making sure O-ring and housings are properly positioned.

(4) Install dowel pins in rear compressor body.

(5) Install suction reed valve.

(6) Install rear valve plate assembly.

(7) Install steel-n-gasket.

(8) Apply light coating of refrigeration oil to new O-ring and carefully place into sealing groove of rear cover.

(9) Install rear cover to rear compression housing.

(10) Hold front compressor body and rear cover together firmly, rotate compressor assembly and place

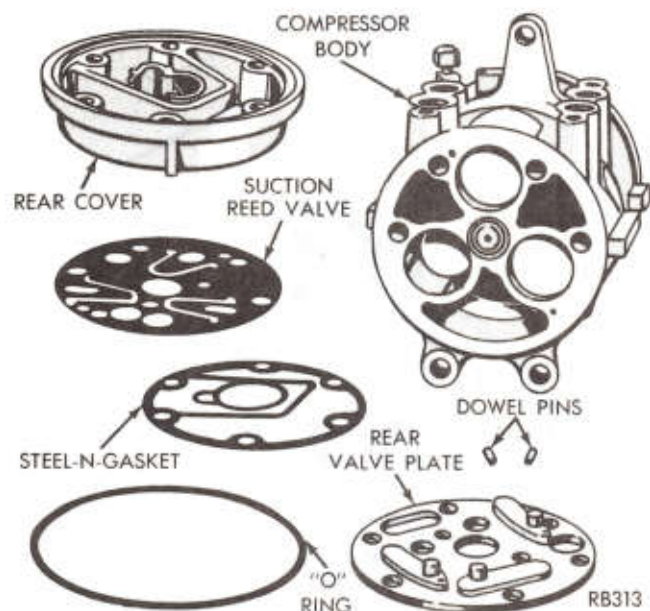


Fig. 11—Disassembling Compressor Rear End

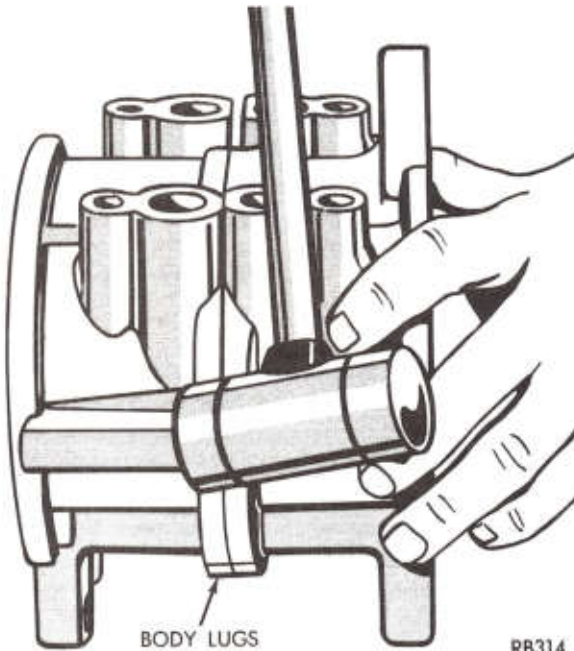


Fig. 12—Separating Body Halves

it on a bench so it is setting firmly on rear cover with crankshaft facing upward.

- (11) Carefully install dowel pins in front compressor body.
- (12) Install suction reed valve.
- (13) Install front valve plate assembly.
- (14) Install steel-n-gasket.
- (15) Carefully clean crankshaft and coat lightly with refrigerant oil.
- (16) Lubricate crankshaft gas seal cartridge lightly with refrigeration oil and install on crankshaft. Car-

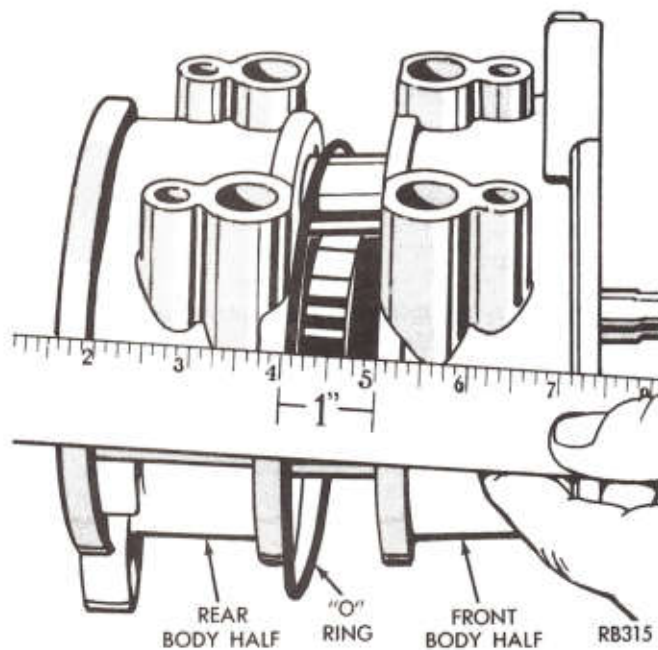


Fig. 13—Compressor Body Half Separation

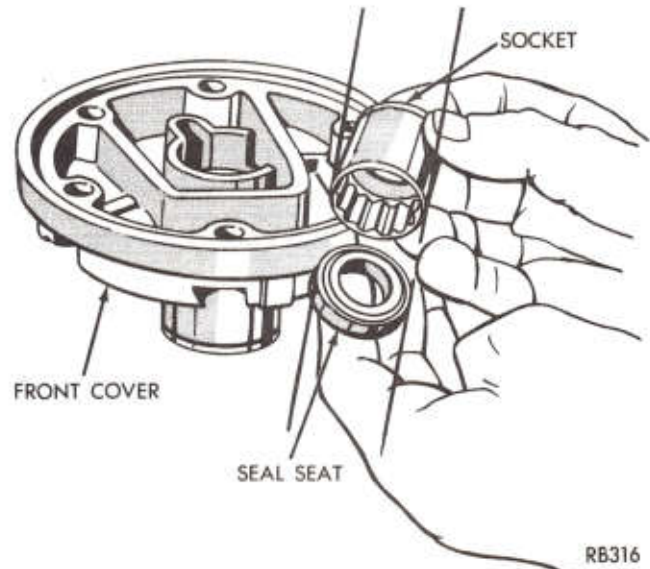


Fig. 14—Match Socket to Outer Seal Diameter

tridge must be properly positioned on slot of crankshaft.

- (17) Lubricate crankshaft seal seat cavity of front housing with refrigeration oil.

- (18) Lubricate crankshaft seal seat and seal seat O-ring with refrigeration oil. Install O-ring on seal seat and install seal seat in front cover using a socket that contacts the outer diameter of the seal seat plate (Figs. 14 and 15).

- (19) Lubricate front cover O-ring with refrigeration oil and carefully place it in seal groove of front housing.

- (20) Carefully install front cover to front compressor body. If cover does not visually align with dowel

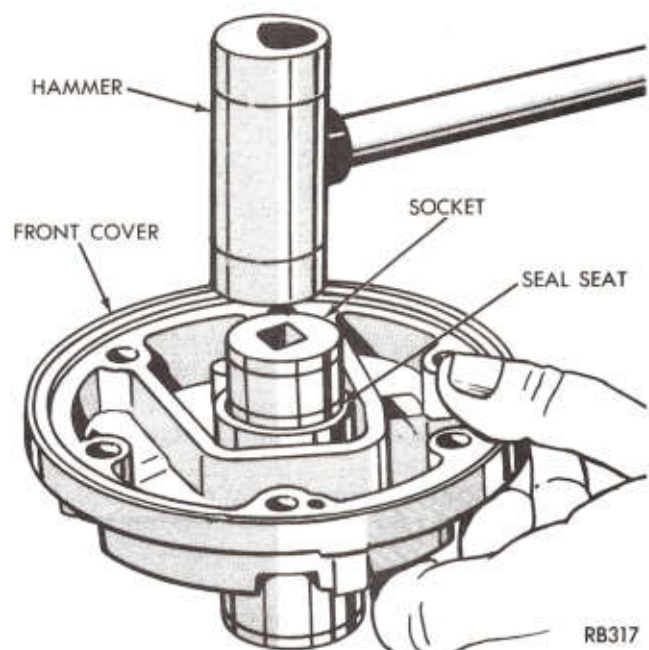


Fig. 15—Installing Seal Seat

pins on installation, completely remove cover and make certain the carbon seal of the crankshaft seal cartridge is properly positioned in the seal cartridge and not sticking to the seal seat plate.

(21) Install six (6) compressor thru bolts and tighten finger tight, then torque to 260 in. lbs. (29 N-m).

(22) Install key in crankshaft.

(23) Install felt shaft seal into front housing and position at base of housing neck.

(24) Install 266 ml (9 fluid ounces) of refrigeration oil (500 SUS) into the compressor through suction port.

(25) Check compressor operation for smoothness by rotating crankshaft at least 5 full revolutions.

(26) Check front housing clutch coil alignment pin for proper installation.

(27) Install clutch. See "Clutch Installation".

Installation

(1) Adjust oil level through the compressor suction port to 5 fl. oz. (148 ml) if necessary. (See "Oil Level" below).

(2) Install the compressor on the vehicle and tighten drive belts. See group 7, "Cooling" for correct belt adjustment. Torque compressor mounting bolts to 40 ± 10 ft. lbs.

(3) Reconnect clutch wire.

(4) Remove caps from suction and discharge lines and suction and discharge ports. Using new gaskets,

install lines onto compressor and tighten to 19 to 26 N-m (170 to 230 inch-pounds).

(5) Evacuate and charge the system.

CAUTION: Clutch should be cycled off and on with engine at fast idle, 15 to 20 times to ensure clutch parts reseal with each other after assembly before clutch engages with high head pressure at the compressor.

OIL LEVEL

When a new compressor is installed at the factory, it contains 7 to 7.25 fl. oz. (207 to 214 ml) of a special wax-free 500 SUS viscosity refrigerant oil. While the air conditioning system is in operation, the oil is carried through the entire system and returns to the compressor by way of the suction port. Some of this oil will be trapped and retained in various parts of the system. Consequently, once the system has been in operation, the amount of oil left in the compressor will always be less than the original amount. Replacement compressors are also charged with 7 to 7.25 fl. oz. (207-214 ml). When replacing a compressor, remove drain oil, measure the amount, and discard old oil. For the replacement compressor use the same amount of refrigerant oil as recovered from failed compressor. This adjustment is not needed if the system has been flushed, removing retained oil.

EVAPORATOR HEATER ASSEMBLY

INDEX

	Page		Page
A/C Distribution Spot Cooler Ducts	41	Faceplate	40
Air Outlet Assemblies	42	General Information	36
Control Chart	38	Louver Assemblies	42
Control Test	40	Operation of All Controls	38
Defroster Duct	42	Resistor Block	41
Electrical Controls and Circuits	40	Temperature Control Cable	40
Evaporator Control Unit	41	Vacuum Actuators	41
Evaporator Heater Assembly	43	Vacuum Controls and Circuits	38

GENERAL INFORMATION

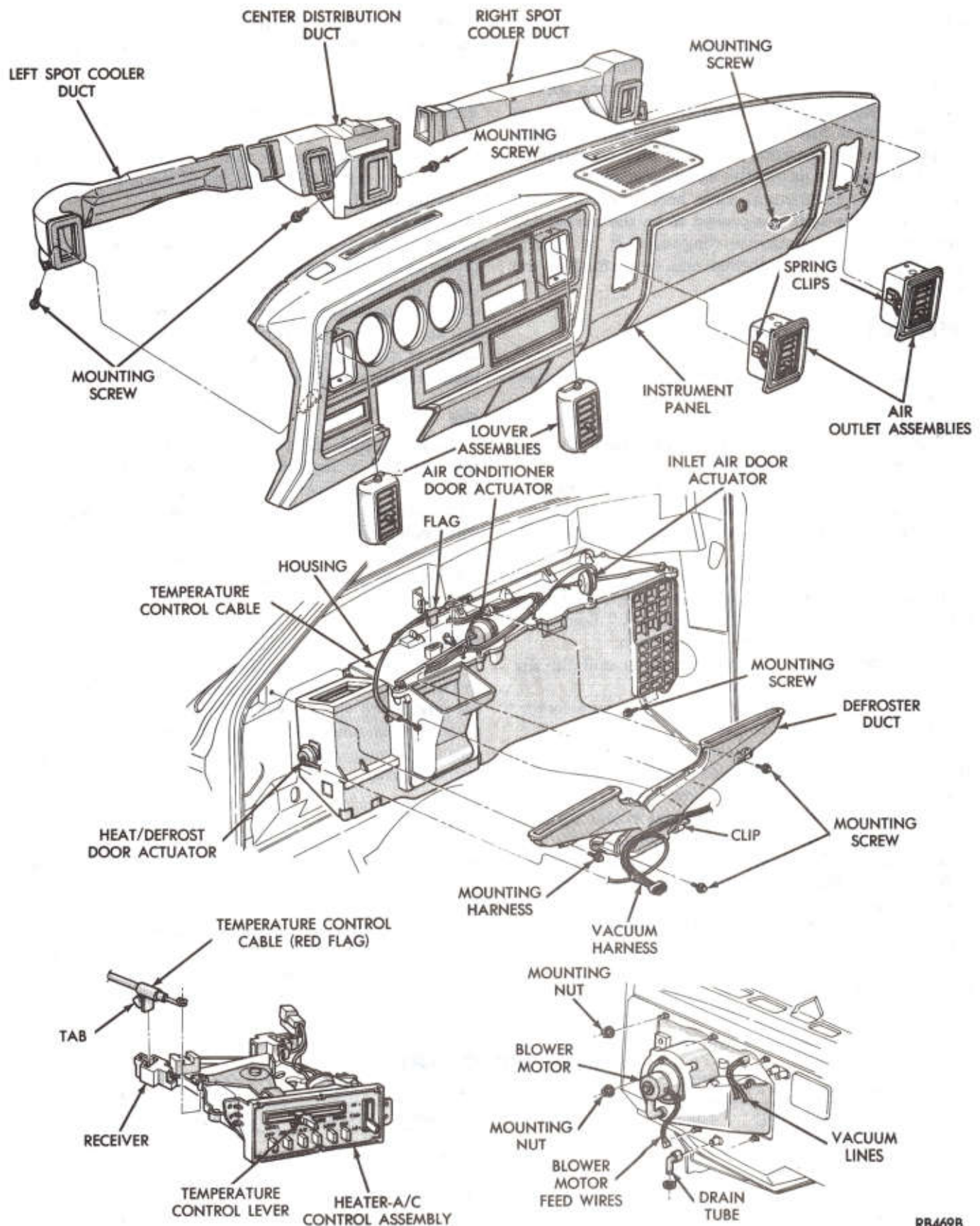
This air conditioner is designed specifically for conventional cab trucks with the heater-evaporator package designed to fit under the instrument panel (Fig. 1). The system is manually controlled by the operator. Controls have been kept simple for ease of service and operation.

In the blend air reheat air conditioning unit, all the air entering the system passes through the evaporator and a selected portion passes through the heater core depending on the position of the blend air door. The system controls are located in the center of the instrument panel within easy reach of the driver. The combination electrical and vacuum switch controls

the compressor clutch, mode of operation and blower. Modes are Off, Max. A/C, A/C, Vent, Heat, and Defrost. A four speed blower motor switch controls the amount of air flow. The evaporator-heater package includes the blower motor, intake duct, with outside air recirculating door, evaporator coil, heater core, defroster discharge doors, blower motor speed resistors, vacuum harness, vacuum actuators and A/C air outlets to the distribution ducts.

Defrost, Heat, A/C and Vent modes automatically supply 100 percent outside air.

The air distribution ducts supply air from the unit to four panel mounted, fully directional, outlets. Two



RB469B

Fig. 1—Heater and Evaporator Assembly

outlets are part of the faceplate and two are snapped into the panel on the right side.

Satisfactory performance of the combined air-conditioning and heating system is dependent upon correct operation and adjustment of all operating controls, as well as correct function of all refrigeration system components. The inspections, tests and adjustments should be used to locate the cause of a malfunction. The tests in this manual have been arranged in a logical sequence that has proved to be the surest and shortest route to accurate diagnosis. It is recommended that they be followed and performed in the order they are presented.

OPERATION OF ALL CONTROLS

Operation must be tested as described in the following sequence:

- (1) Inspect, test, and adjust compressor drive belt.
- (2) Start engine and adjust engine speed to 1300 rpm. Use a reliable tachometer.
- (3) Move temperature control lever to Cool position and mode lever to A/C position.
- (4) The inlet air door should be open to outside air. Open vehicle windows.
- (5) Test the blower operation at all four speed positions. If the blower does not operate correctly refer to "Electrical Controls and Circuit." Leave the blower switch in the "High" (Hi) position.
- (6) The compressor should be running and the air conditioning system in operation.

In addition to the six position push button selector, the A/C Heater control consists of:

Temperature Lever—Controls the temperature of the discharge air in all modes except Max. A/C and Off when the vacuum operated water valve is closed. Moving the lever to the left provides cooler air and moving it to the right provides warmer air.

Blower Switch—The system blower can be operated at four speeds, from low at the bottom, medium 1 at the lower center, medium 2 at the upper center, to high at the top switch position. The blower will be on and operating at the speed selected, in all push button positions except Off.

Air Directional Vanes—Air is delivered through four panel outlets. The four outlets are adjustable up,

down, or to either side and can be shut off by pushing the vanes up. Floor air is delivered through the lower outlets.

VACUUM CONTROLS AND CIRCUITS

For an explanation of the vacuum and electrical logic that controls the operation of the unit see Fig. 2 and Control Chart.

Modes—The vacuum and electrical logic is determined by the push button switch. The vacuum portion of the switch controls the water valve and positions all doors in the unit except the blend air door. The electrical portion of the switch controls the compressor and blower operation. The following is a breakdown of the vacuum and electrical logic for each mode. See control chart in this section.

Off

Vacuum application is as indicated in Fig. 2. The inlet air door is closed to outside, open to recirculating air. The mode door is in the A/C position. The Heat/Defrost door is in the Heat position. The heater core coolant flow is shut-off.

No air flows through the unit and the compressor is idle because the blower and compressor clutch circuits are open.

Max A/C

All of the doors are in the same position as they are in Off. The Max. A/C mode merely closes the electrical circuits to the blower motor and the compressor clutch. This mode is recommended for initial cool down, extreme outside humidity, or high ambient temperature.

A/C

This mode is recommended for use after the vehicle has been cooled to the desired temperature. The vacuum application at the outside-recirculating air door actuator is transferred to the rod side. This moves the door away from the outside-air inlet and closes the recirculating inlet. The water valve is open. All other vacuum applications and door positions are the same for the Max. A/C position. The blower motor and compressor are on.

CONTROL CHART

Control Position	Off	Max. A/C	A/C	Vent	Heat	Defrost
Inlet Air Door (Open To)	Inside	Inside	Outside	Outside	Outside	Outside
Mode Door (Open To)	A/C	A/C	A/C	A/C	Heat	Heat
Heat Defrost (Open To)	Heat	Heat	Heat	Heat	Heat	Defrost
Compressor Clutch	Off	On	On	Off	Off	On
Blower Motor	Off	On	On	On	On	On
Water Valve	Off	Off	On	On	On	On

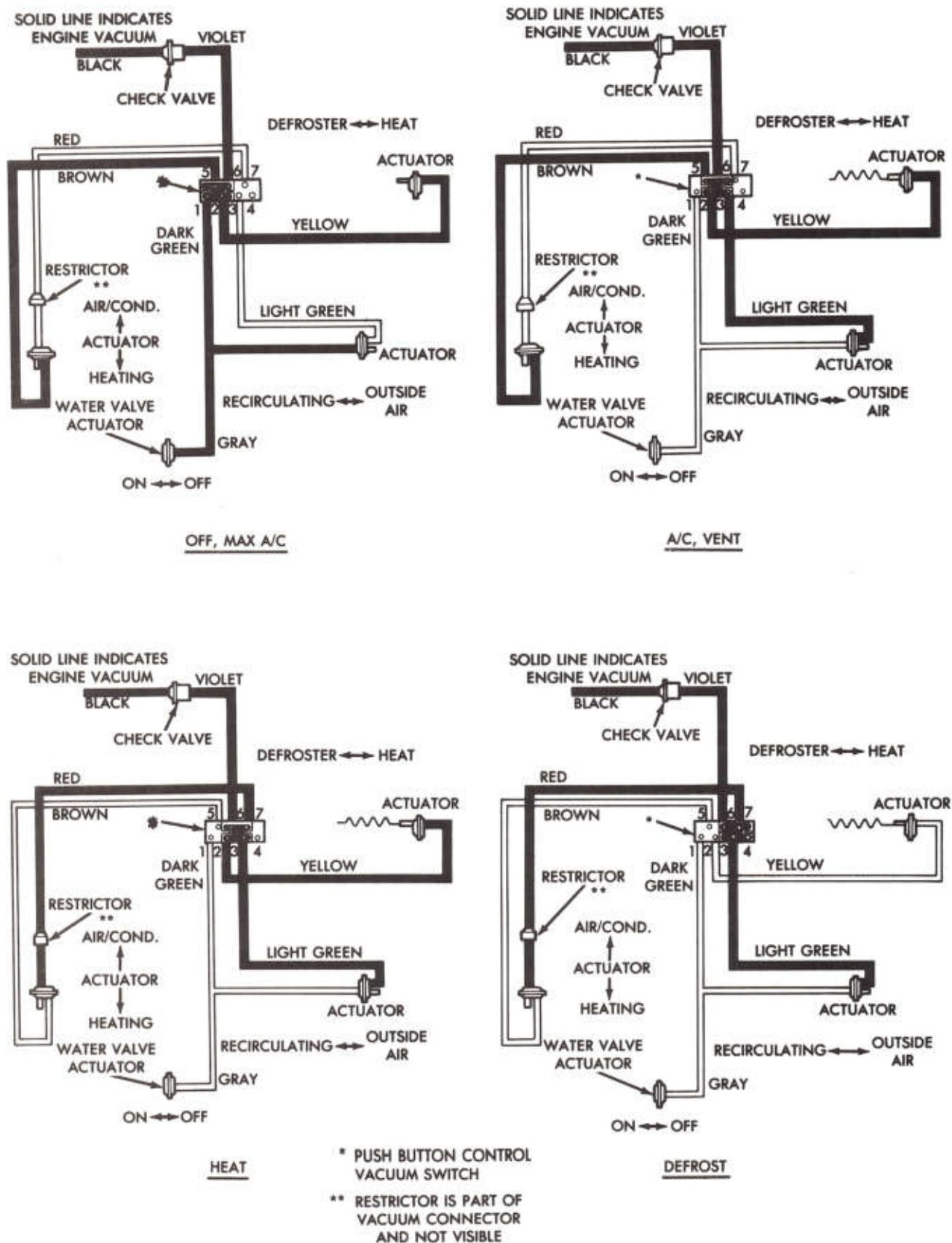


Fig. 2—Vacuum Circuits, Air Conditioning and Heating

Vent

The vacuum circuit remains the same as in the A/C position but the compressor clutch electrical circuit is opened, preventing the compressor from operating. The blower motor is used to force outside air into the passenger compartment through the A/C outlets in the instrument panel.

Heat

In the Heat mode the outside air door is open same as A/C mode.

Vacuum is applied to the top side of the air-conditioning door actuator, closing off the passage to the air conditioning distribution duct and opening the passage to the heater-defroster duct. Since the heater-defroster door is in the heat position, the full flow of heated air goes through the heater outlets, except for a small amount that bleeds through the defroster outlets. The water valve is open, the blower switch is activated and the compressor is off.

Defrost

When the defrost mode is selected all conditions are the same as for heater operation, except that no vacuum is applied to the defrost door actuator which is spring loaded to defrost position. The door opens the defroster outlets and partially closes off the heater outlets. The heater outlets are left open far enough to direct about 30 percent of the air to the floor. The other 70 percent is defrost air directed to the windshield area. The compressor clutch will be engaged.

ELECTRICAL CONTROLS AND CIRCUITS

The electrical feed for the air conditioning circuit is from two fuses in the fuse block. One 20 ampere fuse protects the compressor clutch circuit, and one 30 ampere fuse protects the blower motor control circuit. See (Fig. 3) for complete electrical control circuit.

CONTROL TEST

Test operation of controls in the following manner.

- (1) Inspect compressor drive belt. Adjust if necessary.
- (2) Start engine.
- (3) Move temperature lever to extreme left (cool) position.
- (4) Push A/C button.
- (5) Refer to Control Chart. Check position of doors, operation of compressor clutch, blower motor and water valve. The water valve is open when there is no vacuum to valve.
- (6) Check blower switch by moving it to all four positions and noting air flow change. In case of malfunction refer to Electrical Control Circuit.

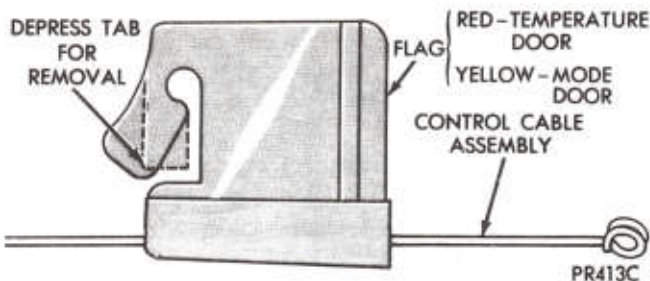


Fig. 3—Flag Tab Depressed for Removal

(7) Check operation of blend air door by moving temperature lever from full warm toward cool position. Discharge air temperature should change with lever movement if the engine coolant is warm.

(8) Repeat steps 5 and 6 in each push-button position.

If acutation of the doors is slow or incomplete, check for mechanical misalignment, binding or vacuum leaks. The air conditioning door has a seven second vacuum delay in mode switching from Off, Max A/C, A/C, or Vent to Heat or Defrost. Check temperature control cable for correct adjustment.

FACEPLATE

Removal

- (1) Remove map lamp (2 screws).
- (2) Remove six (6) screws which attach faceplate to base panel (5 screws under brow of dash and 1 screw below the Heater-A/C control).
- (3) Pull column shift lever in position "1".
- (4) Remove faceplate by pulling top edge rearward to clear the brow, disengage attaching clips around bottom of faceplate, and complete removal of faceplate.
- (5) Disconnect wires to four wheel drive indicator if so equipped.

Installation

- (1) Connect four wheel drive indicator if so equipped.
- (2) Engage attaching clips around bottom of faceplate, roll faceplate into position, and install six (6) mounting screws.
- (3) Install map lamp.

TEMPERATURE CONTROL CABLE

Removal

- (1) Remove faceplate (see "Faceplate Removal").
- (2) Open glovebox past stops.
- (3) Remove control unit from instrument panel by removing two (2) mounting screws and pulling unit out.
- (4) Remove cable from control lever pin and remove

flag from retainer (Fig. 3).

(5) Detach cable from unit by removing self-adjust clip from crank arm and flag from retainer.

(6) Remove cable assembly through glovebox opening.

(7) Place a 7mm (1/4 inch) I.D. tube over clip and pry self-adjust clip off core wire if required (Fig. 4).

Installation

(1) Position self-adjust clip on cable core wire 50mm (2 inches) from the small loop at evaporator assembly flag end. With a 7mm (1/4 inch) I.D. tube, snap self-adjust clip on core wire (Fig. 4).

(2) Install cable assemblies through glovebox opening.

(3) Attach self-adjust clip to crank arm and install flag in receiver on evaporator assembly.

(4) Install flags in retainers and attach cable to control lever on control unit.

(5) Install control unit into instrument panel and secure with two (2) mounting screws.

(6) Install faceplate (see "Faceplate Installation").

EVAPORATOR CONTROL UNIT

Removal

(1) Remove faceplate (see "Faceplate Removal").

(2) Remove two (2) attaching screws.

(3) Pull control unit out, away from instrument panel.

(4) Disconnect blower control switch wiring connector.

(5) Disconnect three (3) wiring connectors to control.

(6) Disconnect illumination light.

(7) Disconnect vacuum harness.

(8) Disconnect temperature control cable (see "Temperature Control Cable Removal").

(9) Remove control.

Installation

(1) Connect temperature control cable (see "Tem-

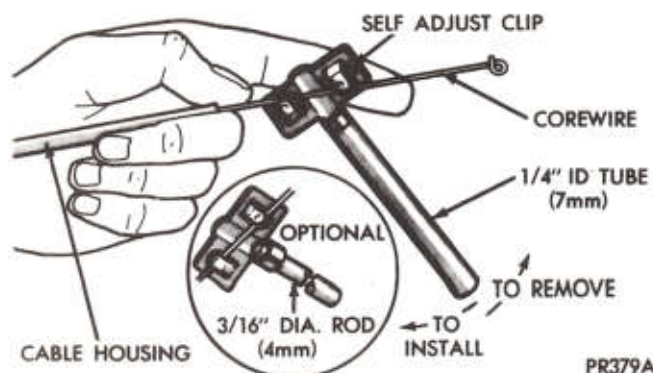


Fig. 4—Removing or Installing Self-Adjust Clip

perature Control Cable Installation").

(2) Install illumination light.

(3) Install three (3) wiring connectors to pushbutton switch and vacuum harness.

(4) Connect blower motor control switch wiring connector.

(5) Place control unit in place in instrument panel and secure with two (2) attaching screws.

(6) Install faceplate.

RESISTOR BLOCK

Removal

(1) Remove connector from resistor block.

(2) Remove two (2) mounting screws (Fig. 6).

(3) Remove resistor block.

Installation

(1) Place resistor block on plenum.

(2) Install two (2) mounting screws.

(3) Connect wiring connector.

VACUUM ACTUATORS

The mode and air recirculator actuators are serviced through the glovebox opening after opening the glovebox past its stops.

The heater/defroster actuator is serviced under the instrument panel on the left end of the A/C-ULV unit.

AIR CONDITIONER DISTRIBUTION AND SPOTCOOLER DUCTS

Center Distribution Duct

Removal

(1) Disconnect negative battery cable.

(2) Open glove box past stops.

(3) Remove right upper air duct by removing one (1) mounting screw and pulling duct out through glovebox opening (Fig. 1).

(4) Remove instrument panel center brace.

(5) Remove right kick pad.

(6) Remove right instrument panel pivot bolt.

(7) Remove instrument panel cluster (see "Instrument Panel", Group 8).

(8) Disconnect shift indicator cable.

(9) Lower steering column.

(10) Remove steering column studs.

(11) Remove radio.

(12) Remove two (2) mounting screws and remove scoop connecting heater unit to center distribution duct.

(13) Remove two (2) mounting screws and remove center distribution duct by pulling bottom of instrument panel out and dropping duct out (Fig. 1).

Installation

To install center distribution duct, reverse removal procedure.

Right Bi-Level Duct**Removal**

- (1) Disconnect negative battery cable.
- (2) Open glove box past stops.
- (3) Remove right upper air duct by removing one (1) mounting screw and pulling duct out through glove-box opening (Fig. 1).

Installation

To install right bi-level duct, reverse removal procedure.

Left Bi-Level Duct**Removal**

- (1) Disconnect negative battery cable.
- (2) Remove instrument panel cluster (see "Instrument Panel", Group 8).
- (3) Disconnect shift indicator cable.
- (4) Remove heater control (see "Heater Control Removal").
- (5) Remove three (3) mounting screws and cover that retains instrument panel wiring and let wiring hang free.
- (6) Remove one (1) mounting screw and slide left air duct out through instrument cluster opening (Fig. 1).

Installation

To install left bi-level duct, reverse removal procedure.

**AIR OUTLET ASSEMBLIES
RIGHT SIDE****Removal**

Both right side outlets are held in place with spring loaded retaining clips.

- (1) With outlet facing out and louver vanes open, grasp adjusting vane with fingers.
- (2) Pull smoothly and firmly to unseat clips and complete removal toward rear of vehicle.

Installation

- (1) Position outlet assembly in panel opening, making sure lettering stamped "Top" is up. (ribs on housing match notches on instrument panel).
- (2) Press housing assembly until both retaining clips lock into place.

LOUVER ASSEMBLIES (Fig. 1)**Removal**

- (1) Remove faceplate (see "Faceplate Removal").

(2) Set faceplate with trim surface down, insert a small screwdriver tip into the outlet housing pivot hole.

(3) While forcing down louver assembly pivot pin, pull louver assembly out of rear of faceplate.

Installation

(1) Position louver assembly, bottom pivot first, into the faceplate outlet housing. The bottom pivot pin is of smaller diameter than the top pivot pin.

(2) While deflecting the upper louver assembly pivot pin, carefully swing the assembly into housing, so the felt pads are not damaged. Insure top and bottom pivot pins are properly engaged.

(3) Install faceplate.

DEFROSTER DUCT**Removal**

- (1) Disconnect negative battery cable.
- (2) Open glove box past stops.
- (3) Remove right upper air duct by removing one (1) mounting screw and pulling duct out through glove-box opening (Fig. 1).
- (4) Remove instrument panel center brace.
- (5) Remove right kick pad.
- (6) Remove right instrument panel pivot bolt.
- (7) Remove instrument panel cluster (see "Instrument Panel", Group 8).
- (8) Disconnect shift indicator cable.
- (9) Lower steering column.
- (10) Remove steering column studs.
- (11) Remove radio.
- (12) Remove two (2) mounting screws and remove scoop connecting heater unit to center distribution duct.
- (13) Remove two (2) mounting screws and remove center distribution duct by pulling bottom of instrument panel out and dropping duct out (Fig. 1).
- (14) Remove heater control (see "Heater Control Removal").
- (15) Remove three (3) mounting screws and cover that retains instrument panel wiring and let wiring hang free.
- (16) Remove one (1) mounting screw and slide left air duct out through instrument the cluster opening (Fig. 1).
- (17) Remove three (3) screws attaching defroster duct to dash panel (Fig. 1).
- (18) Reach in through instrument panel opening and disengage snaps to separate defroster duct into two pieces.
- (19) Remove defroster duct halves through instrument cluster opening.

Installation

To install defroster duct, reverse removal procedure.

EVAPORATOR HEATER ASSEMBLY

Removal

- (1) Disconnect negative battery cable. Discharge refrigerant, disconnect refrigerant and heater lines from unit on engine side.
- (2) Plug heater hoses and unit and remove condensate tube (Fig. 1).
- (3) Move transfer case and/or gear shift levers away from instrument panel.
- (4) Remove right cowl side trim panel if so equipped.
- (5) Remove glovebox by removing four (4) mounting screws at base and swinging out from the bottom to avoid catch and stops.
- (6) Remove structural brace through glovebox opening. Remove two (2) screws, loosen two (2) nuts.
- (7) Remove ash receiver.
- (8) Remove right half of lower reinforcement by removing seven (7) screws attaching it to the instrument panel and one (1) to the cowl side trim panel.
- (9) Detach radio ground strap.
- (10) Remove center distribution duct (see Air Conditioner Distribution and Spot Cooler Ducts).
- (11) Remove floor air distribution duct.
- (12) Disconnect temperature control cable from unit through glovebox and tape out of way (see "Temperature Control Cable Removal").
- (13) Disconnect vacuum lines from extension on control unit and unclip vacuum lines from defroster duct (see Fig. 1).
- (14) Remove wiring connector from resistor block.
- (15) Remove blower motor connector on engine side.
- (16) Disconnect vacuum lines on engine side, make sure grommet is free from dash panel.
- (17) Remove seven (7) retaining nuts on engine side.
- (18) Remove screw that retains package to cowl side sheetmetal.
- (19) Remove package. Plastic instrument panel may have to be flexed outward.

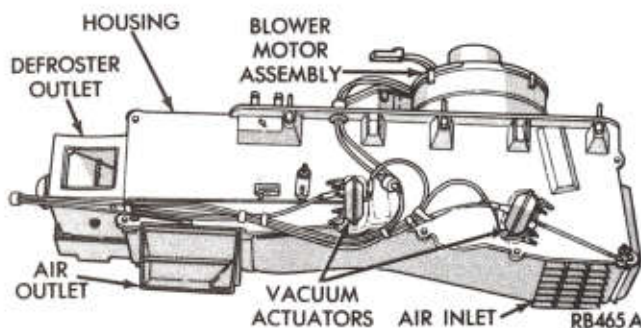


Fig. 5—Evaporator Heater Assembly

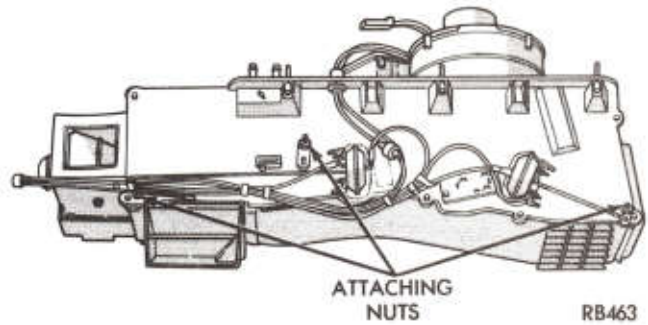


Fig. 6—Removing Door Arms

Inspection

- (1) Remove one (1) nut each that attaches three door arms to doors on the top cover of the unit and remove the three door arms (Fig. 6).
- (2) Remove seven (7) screws to separate cover from housing.
- (3) Slide out evaporator core.
- (4) Remove mounting screw and slide out heater core.
- (5) Disconnect blower motor feed wire on engine side.
- (6) Remove three retaining screws to separate blower motor from housing.
- (7) Separate fan from motor (Fig. 7).
- (8) Inspect all parts.
- (9) Assemble evaporator heater unit using necessary new parts by reversing this disassembly procedure.

Installation

To install evaporator heater unit, reverse removal procedure. Be sure to refill the cooling system and evacuate and recharge the system. Check operation of all controls and performance of the A/C system.

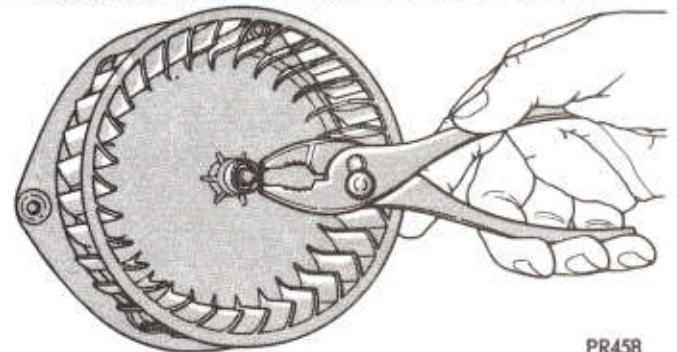


Fig. 7—Removing Blower Wheel

EMISSION CONTROL SYSTEMS

CONTENTS

	Page		Page
AIR INJECTION SYSTEM	14	GENERAL INFORMATION	1
ELECTRIC ASSIST CHOKE SYSTEM	1	HEATED INLET AIR SYSTEM	3
EVAPORATION CONTROL SYSTEM (ECS)	21	MAINTENANCE REQUIRED LIGHT	1
EXHAUST GAS RECIRCULATION	7		

GENERAL INFORMATION

All Federal models regardless of Gross Vehicle Weight Rating (GVWR) must meet Light Duty Cycle Emission Standards.

Vehicles built for sale in California and Canada having a GVWR of 8,500 lbs. (3 855 kg) or less, must meet Light Duty Cycle Emission Standards.

Vehicles built for sale in California and Canada having a GVWR of 8,501 lbs. (3 860 kg) or more must conform to Heavy Duty Emission Cycle Standards.

Maintenance requirements for Light Duty and Heavy Duty Cycle emission systems differ because of different load and operating conditions.

MAINTENANCE REQUIRED LIGHT

There are some systems and components that need periodic maintenance; such as the PCV valve, EGR system, the heated oxygen sensor, and some vacuum operated components.

A maintenance required light on the instrument cluster alerts the driver when maintenance is needed. The system is based on time, rather than mileage. When the predetermined time is reached, the light is turned on. When proper maintenance is performed, the light can be turned off by using the procedure in Group 8E of this Service Manual.

ELECTRIC ASSIST CHOKE SYSTEM

INDEX

	Page		Page
Choke Heating Element Test	2	Servicing Choke Assembly	2
Choke System Rochester Carburetor	1	Test Procedures	1
Dual Stage Control 5.9L	1	Thermostatic Choke	2

Choke System Rochester Carburetor (Fig. 1)

The off-set choke valve is mounted in the air horn above the primary carburetor venturi. The closed choke valve provides the correct air/fuel mixture enrichment for cold engine starting. The choke valve also assists engine running during the warm-up period.

An electric choke coil is mounted in the choke housing. This system uses electric current supplied to the choke coil which combined with the off-set choke valve and throttle position, control choke operation.

Dual Stage Control 5.9L

The dual stage electric assist choke control is designed to shorten choke duration above approximately 55°F and stabilize choke duration in winter. Summer electric assist heat is hotter than the winter assist level.

Winter heat levels are established by an electrical resistor permanently connected to both terminals of the control. Below 30°F, electric power is reduced by

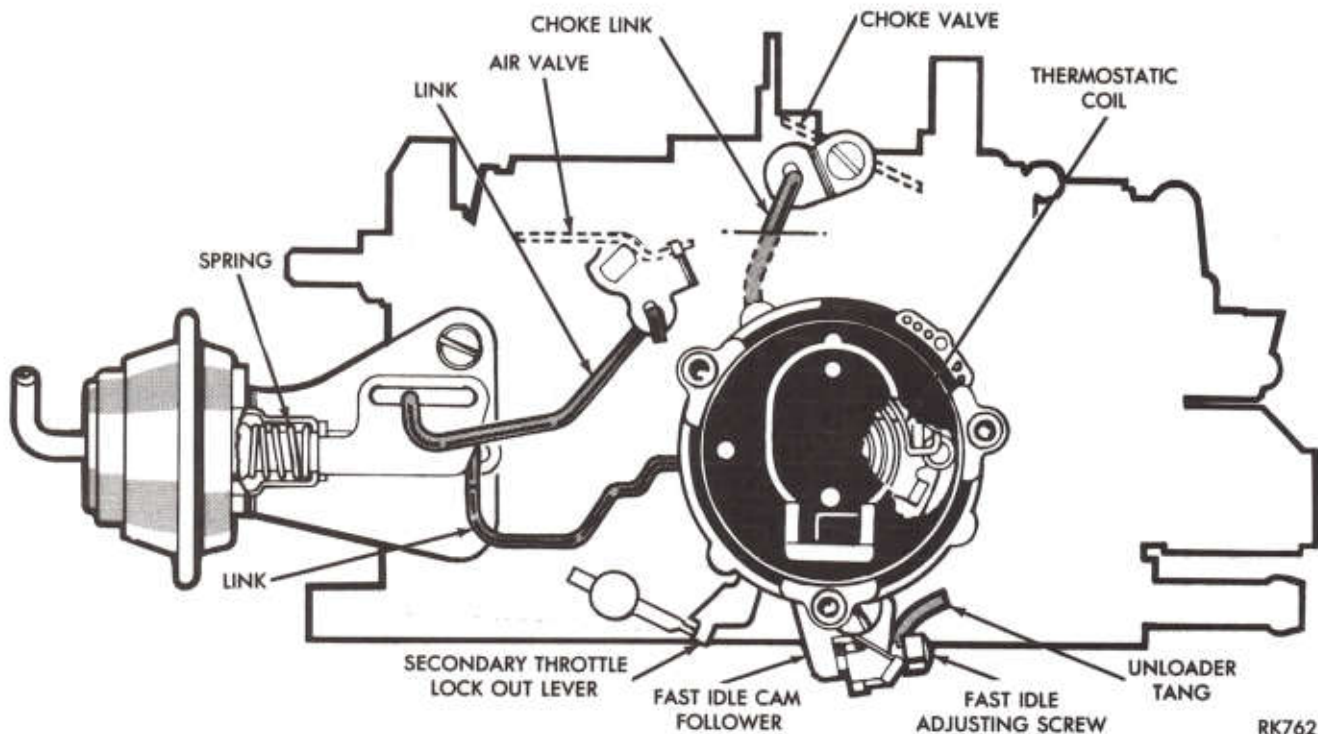
the resistor. Above 55°F, the resistor is bypassed by a switch inside the control to supply full power. The control resistor is very warm when in use.

Switch temperature is controlled by engine temperature. Engines started in winter conditions will experience two levels of choke heat; LOW during engine warm-up and HIGH after engine warm-up. High winter heat levels occur after the choke is open to insure an open choke condition under all driving conditions. High heat levels also minimize choking action which can develop after short stops in the winter.

Engines started in summer temperatures will not experience low choke heat levels. Engines restarted hot will only experience the high heat or summer level because the control switch is generally warmer than 55°F.

Test Procedures

(1) Check test light by connecting between battery terminals of vehicle battery. Take careful note of bulb light intensity. (Dual stage control only)



RK762

Fig. 1—Choke System (Rochester Carburetor)

(2) Before starting engine, remove ignition harness electrical connector from control switch.

(3) Connect test light to load (choke) terminal of control switch and to ground.

(4) Start engine and allow to reach normal operating temperature.

(5) Apply 12 volts to ignition harness terminal of control switch. If test light does not light or does not have same intensity as Step (1) above, control switch is defective and must be replaced.

Choke Heating Element Test

(1) Disconnect only the B+ wire from the control switch.

(2) Connect an ohmmeter lead to the choke housing or choke retainer screw.

(3) Touch the other meter lead to a bare portion of the choke wire connector at the switch (not the B+ terminal).

(4) Electrical resistance of 4 to 12 ohms indicates the heating element is electrically functional. Only

meter readings indicating an open or a short circuit are cause for installation of a new choke assembly.

Servicing the Choke Assembly

The electric assist choke system does not change any carburetor or choke system procedures and cannot be adjusted. However, the choke linkage and shaft must move freely hot or cold.

Choke rods must be examined carefully for damage or bending. Caution must be taken during installation of carburetors, to prevent damaging entrapment of the choke rod. If the rod becomes trapped, release it by removal instead of force. A bent rod will not function properly.

THERMOSTATIC CHOKE

Vehicles (over 6000 GVW) (2721 kg) are equipped with a non-adjustable thermostatically controlled automatic choke. This type of choke utilizes engine heat only to position the choke valve.

HEATED INLET AIR SYSTEM

INDEX

	Page		Page
Dual Snorkel Air Cleaner	6	Service Procedures	3
General Information	3	Vacuum Diaphragm	
Sensor		Installation	5
Installation	6	Removal	4
Removal	5		

GENERAL INFORMATION

All engines that are used this year come equipped with heated inlet air systems.

This device is a part of the air cleaner and controls the inlet air temperature, so the air fuel mixture can be calibrated when ambient temperatures are low. By maintaining the temperature, the air fuel mixture can be calibrated much leaner to reduce hydrocarbon emissions, engine warm-up characteristics are improved and icing is minimized.

The heated air system is basically a two circuit air flow system.

(1) When the ambient air temperature is 10°F or more below the control temperature, intake air will flow through the stove, into a flexible connector, into the adapter on the bottom of the snorkel and into the air cleaner.

(2) When the ambient air temperature is 15°F or more above the control temperature the air flow will be through the fresh air inlet.

When the ambient air temperature is between these temperatures there will be air flow through both circuits after the engine has been started and the exhaust manifold starts to give off heat. The colder the ambient air the greater the flow of air through the stove, and the warmer the air the greater the flow through the snorkel. The quantity of air through each circuit is controlled by a heat control door in the snorkel to maintain a predetermined temperature at the temperature sensor mounted inside the air cleaner housing (Fig. 1).

The modulation of the induction air temperature is performed by intake manifold vacuum, a temperature

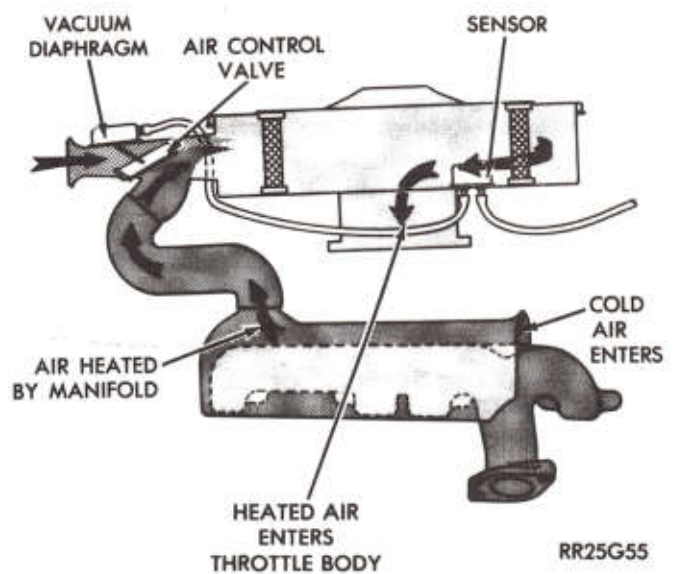


Fig. 1—Heated Air Inlet System (Typical)

sensor and a vacuum diaphragm which operates the heat control door in the snorkel.

With the vacuum diaphragm opposed by a spring, temperature modulation will occur only at road load throttle positions or when the intake manifold vacuum is above the operating vacuum of the vacuum diaphragm.

SERVICE PROCEDURE

Improper functioning of this system will affect driveability as well as the vehicle exhaust emission.

To determine whether the system is functioning properly, the following procedure should be used:

(1) Make sure all vacuum hoses (Fig. 2), the stove to air cleaner flexible connector, and the air cleaner duct are properly attached and are in good condition.

(2) With a cold engine and ambient temperature less than 50°F 5.9L 44°C (110°F) 3.9L and 5.2L, the heat control door (valve plate) in the snorkel should be in the **up** or **heat on position**.

(3) With the engine warmed up and running, check

the air temperature entering the snorkel or at the sensor. When the air temperature entering the outer end of snorkel is 100°F 5.9L 54°C (130°F) 3.9L and 5.2L or higher the door should be in the **down** position (**heat off**).

(4) Remove the air cleaner from the engine and allow it to cool down to 50°F 5.9L 44°C (110°F) 3.9L and 5.2L. With 20 in. Hg. vacuum applied to the sensor the door should be in the **up** or (**heat on**) position. Should the door not rise to the heat on position, check the vacuum diaphragm for proper operation.

(5) To test the diaphragm, apply 20 inches of vac-

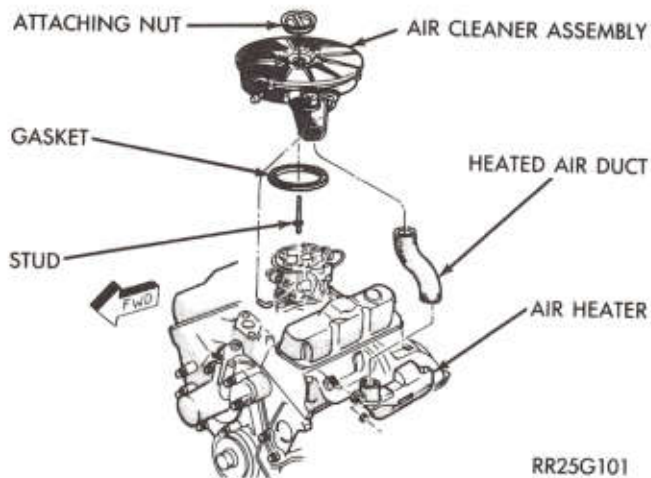


Fig. 2—Heated Air Inlet System

uum with a vacuum pump (Fig. 3). The diaphragm should not bleed down more than 10 inches in 5 minutes. The door should not lift off the bottom of the snorkel at less than 5.5 inches Hg and be in full up position with no more than 8.5 inches Hg.

(6) Should the vacuum diaphragm not perform adequately, replace it and repeat the checks in steps 2 and 3.

(7) Should the vacuum diaphragm perform adequately but proper temperature is not maintained, replace the sensor and repeat the temperature checks in steps 2 and 3.

VACUUM DIAPHRAGM

Removal

(1) Remove the air cleaner housing from vehicle. Disconnect vacuum hose from the diaphragm, drill through the rivet (Fig. 8), then tip the diaphragm slightly forward to disengage lock. When the diaphragm is free from the snorkel, slide the complete assembly to one side to disengage operating rod from heat control door (Fig. 9).

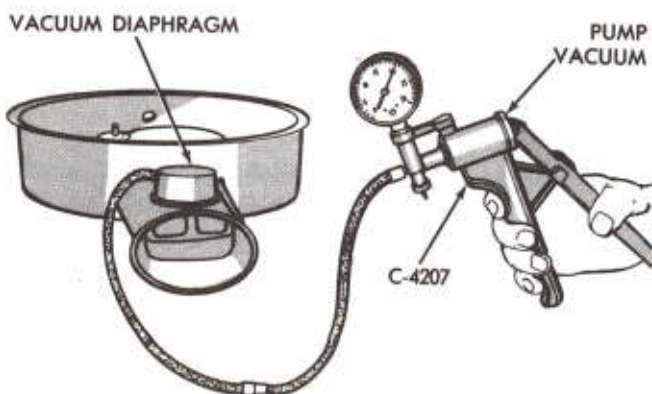


Fig. 3—Testing Vacuum Diaphragm

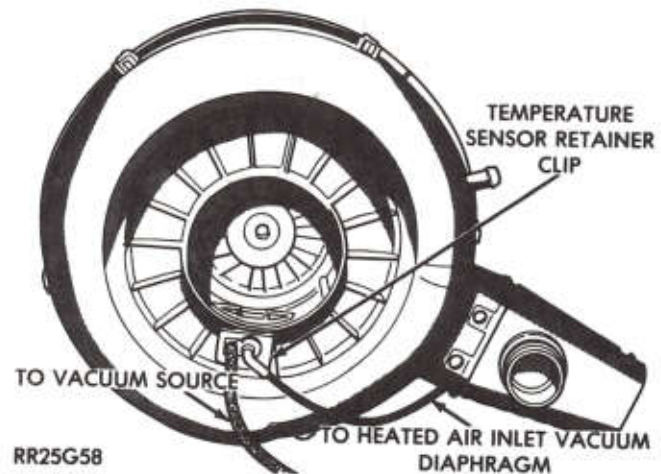


Fig. 4—Typical Vacuum Hose Routing

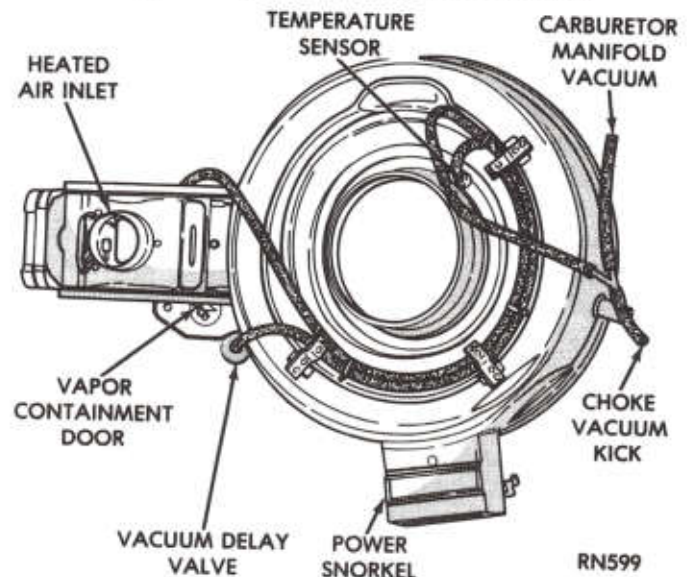


Fig. 5—Dual Snorkel Air Cleaner Vacuum Hose Routing

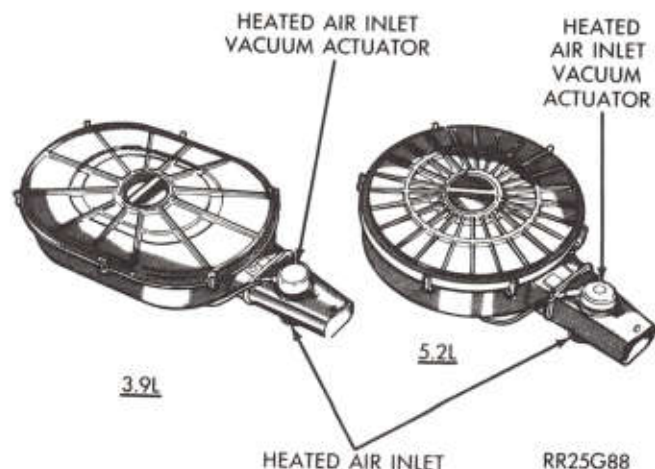


Fig. 6—TBI Air Cleaners

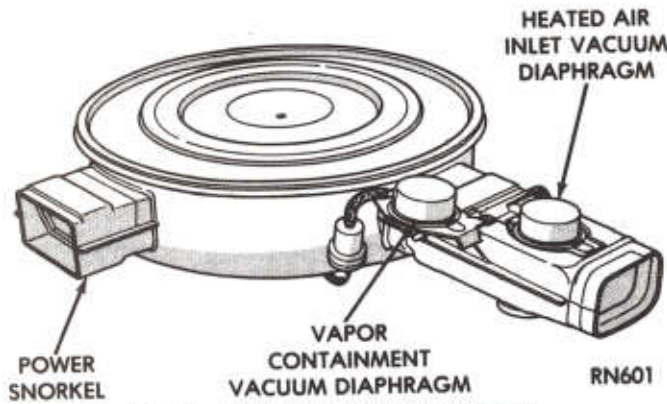


Fig. 7—Dual Snorkel Air Cleaner

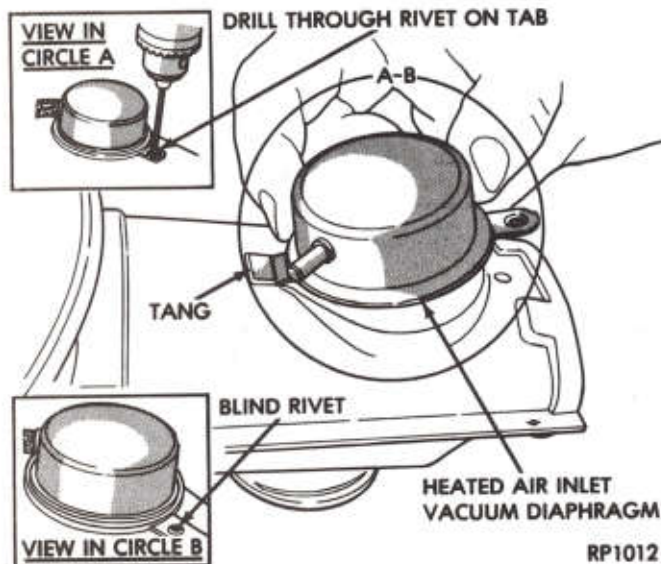


Fig. 8—Removing Diaphragm Rivet

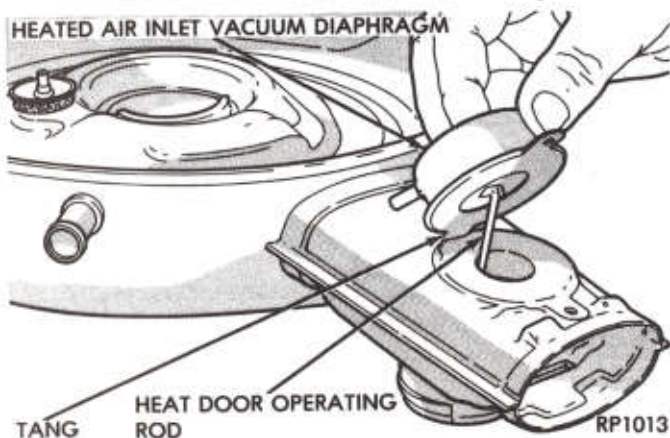


Fig. 9—Servicing Diaphragm

(2) With the vacuum diaphragm removed, check the door for freedom of travel. When the door is raised to the up position, it should fall freely when released. If it does not, observe door to snorkel side walls for interference of foreign matter. Also check hinge pin for foreign matter. Try to release by blowing with

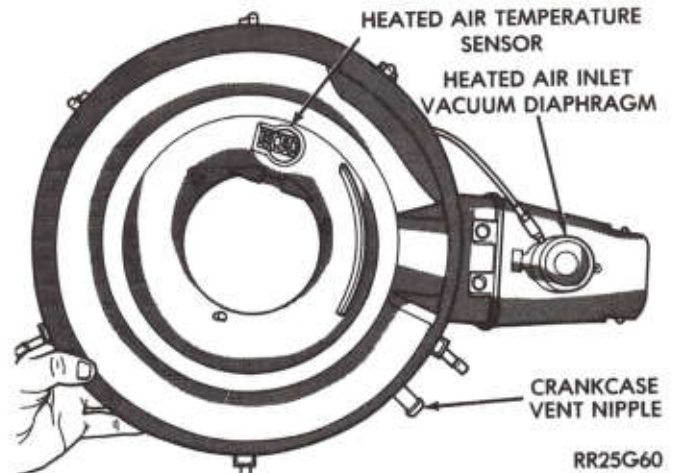


Fig. 10—Air Cleaner Components

compressed air or by releasing the interference.

Installation

(1) Insert operating rod into heat control door. Position diaphragm tang into opening in snorkel. Rivet tab in place (Fig. 9).

(2) Apply 4 inches of vacuum to diaphragm hose nipple, the heat control door should operate freely. **Manually operating heat control door could cock the operating rod or diaphragm which would restrict proper operation of the system.**

(3) Assemble air cleaner, install on vehicle and test operation.

SENSOR

Removal

With air cleaner housing removed from vehicle.

(1) Disconnect vacuum hoses from temperature sensor, remove retainer clips (Figs. 11 and 12), and

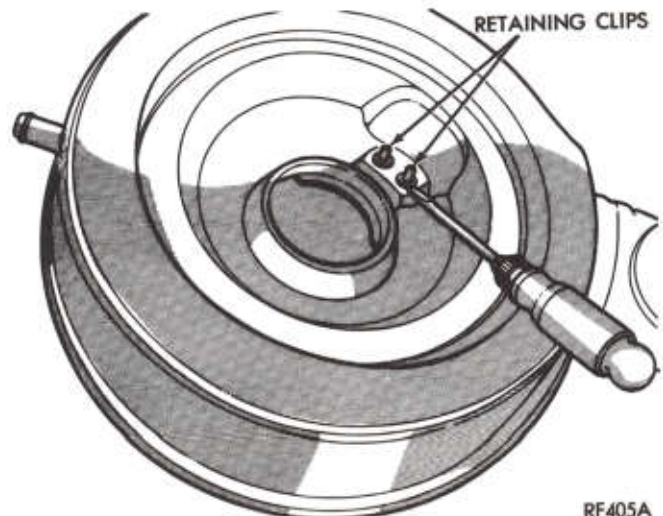


Fig. 11—Removing Sensor Retaining Clip (Carbureted Engines)

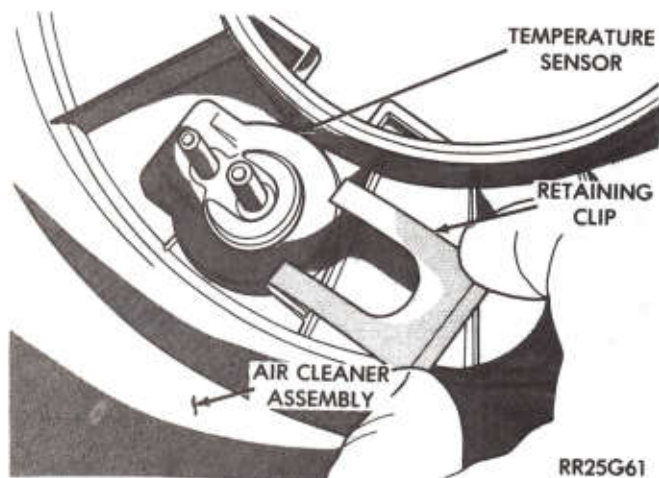


Fig. 12—Removing Sensor Clip (Fuel Injected Engines)

- discard (new clips are supplied with a new sensor).
 (2) Remove sensor with gasket and discard.

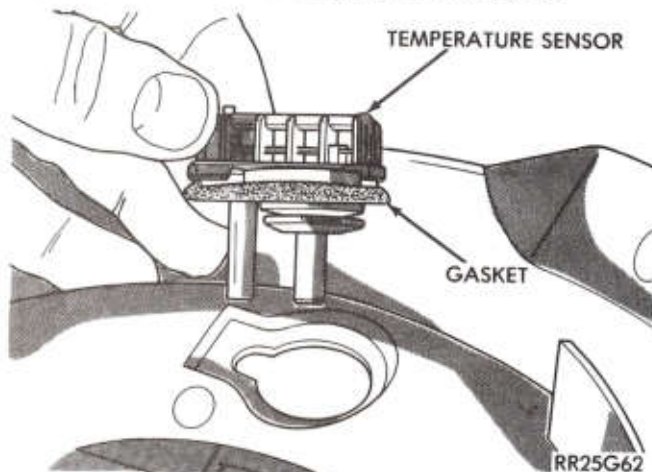


Fig. 13—Servicing Sensor (Fuel Injected Engines)

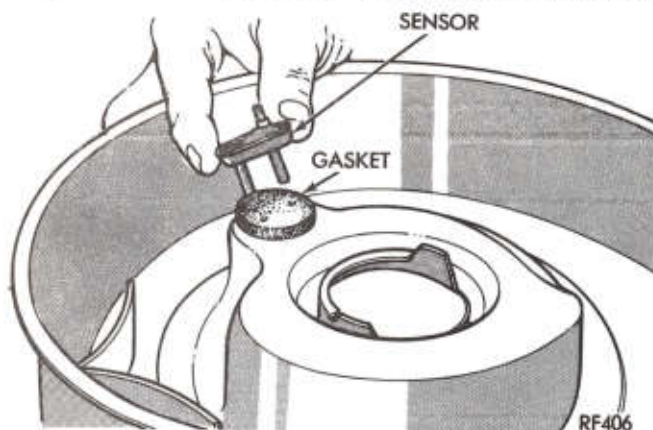


Fig. 14—Servicing Sensor (Carbureted Engines)

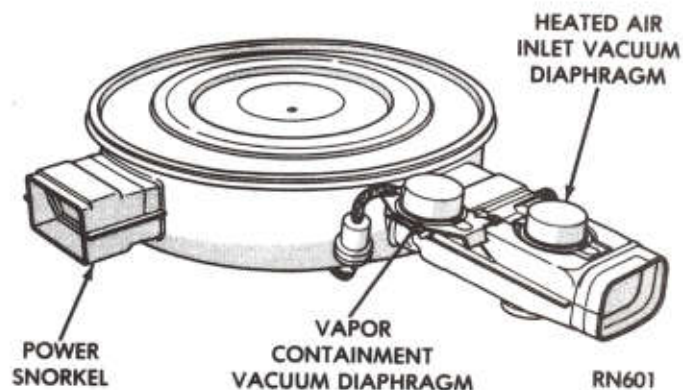


Fig. 15—Dual Snorkel Air Cleaner

Installation

- (1) Position gasket on air cleaner housing and install sensor (Figs. 13 and 14).
- (2) Supporting sensor on outer diameter, install new retainer clips securely being sure gasket is compressed to form an air seal. **No attempt should be made to adjust sensor.**
- (3) Reconnect Vacuum hoses to Temperature Sensor.

DUAL SNORKEL AIR CLEANER (Fig. 15 and 16)

The dual snorkel air cleaner performs basically like a single snorkel air cleaner with one exception:

- (1) On deep throttle accelerations, the power snorkel opens (when intake manifold vacuum drops below 5 inches Hg).

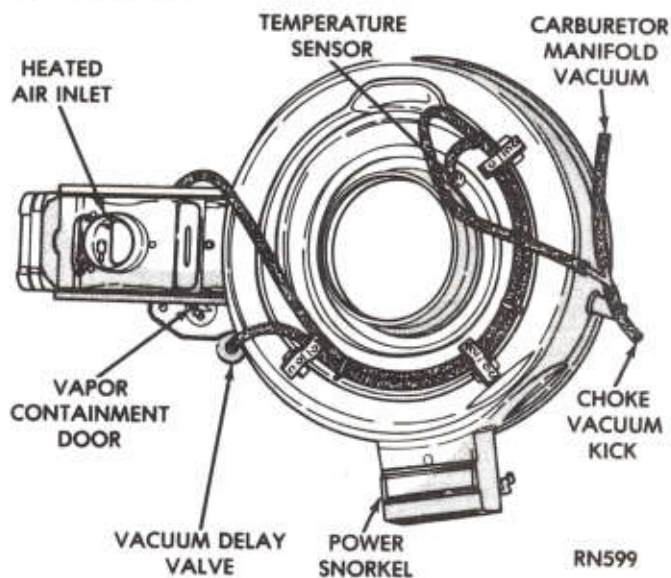


Fig. 16—Dual Snorkel Air Cleaner Components

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

INDEX

	Page		Page
Charge Temperature Switch (CTS)	8	Exhaust Gas Recirculation (EGR) System	
Coolant Temperature Sensor	8	On Board Diagnostics (California Only)	7
Coolant Vacuum Switch Five (5) Port	8	General Information	7
Exhaust Gas Recirculation (EGR) Diagnosis	10	Heated Oxygen O ₂ Sensor	13
Exhaust Gas Recirculation (EGR) Gas Flow Test ..	9	Heated Oxygen O ₂ Sensor Service	13
Exhaust Gas Recirculation (EGR) System	9	Service Procedures	9
Exhaust Gas Recirculation (EGR) System Test ...	9	Venturi Vacuum Control System (5.9L-4V)	7
Exhaust Gas Recirculation (EGR) Valve Service	9,10		

GENERAL INFORMATION

The EGR system reduces oxides of nitrogen (Nox) in engine exhaust and helps prevent spark knock. This is accomplished by allowing a predetermined amount of hot exhaust gas to recirculate and dilute the incoming fuel/air mixture. This dilution reduces peak flame temperature during combustion.

The EGR system for the 3.9L and 5.2L engines is a backpressure type. A backpressure transducer measures the amount of exhaust gas backpressure on the exhaust side of the EGR valve and varies the strength of the vacuum signal applied to the EGR valve. The transducer uses this backpressure signal to provide the correct amount of Exhaust Gas Recirculation under all conditions.

The EGR system on 5.9L engine uses a Venturi vacuum controlled EGR valve to modulate exhaust gas flow into the intake manifold. The 3.9L and 5.2L engines use manifold vacuum controlled by a vacuum solenoid.

EGR SYSTEM ON-BOARD DIAGNOSTICS (CALIFORNIA VEHICLES ONLY)

All California vehicles with EGR systems (EXCEPT

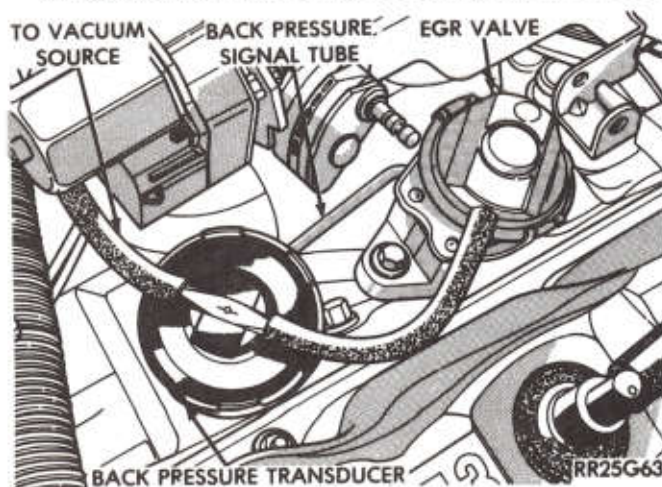


Fig. 1—EGR Valve Mounting 3.9L and 5.2L Engines

5.9L engines) have an On-Board Diagnostic System for the EGR system. The Diagnostic System uses a solenoid in the vacuum signal line to the EGR valve.

The Diagnostic System Check is activated only during selected engine/driving conditions to avoid mis-diagnosis, and checks the entire EGR system for failures. The SMEC monitors EGR system performance and registers a fault code if the system has failed or degraded, and the dash-mounted check engine light is turned on indicating immediate service is required.

If a malfunction is indicated by a check engine light and a fault code for EGR system, proper operation of the EGR system should be checked using the Service Procedures. If the EGR system is found to be functioning correctly, the on-board diagnostics system should then be checked.

VENTURI VACUUM CONTROL SYSTEM (5.9L-4V)

The venturi vacuum control system utilizes a vacuum tap at the throat of the carburetor venturi to provide a control signal. Because of the low amplitude of this signal, it is necessary to use a vacuum amplifier to increase the vacuum to the level required to operate the EGR valve. Elimination of EGR at wide open throttle is accomplished by a dump diaphragm which compares venturi and manifold vacuum to determine when wide open throttle is achieved. At wide open throttle, the internal reservoir is "dumped," limiting output to the EGR valve to manifold vacuum. The valve opening point is set above the manifold vacuums available at wide open throttle, permitting the valve to be closed at wide open throttle. This system is dependent primarily on engine intake airflow as indicated by the venturi signal, and is also affected by intake vacuum and exhaust gas pressure.

This system is disabled when the engine is not at normal operating temperature by a solenoid controlled by the ESA (or an external timer) utilizing a coolant temperature switch or sensor (described below), or by a coolant vacuum switch (described below).

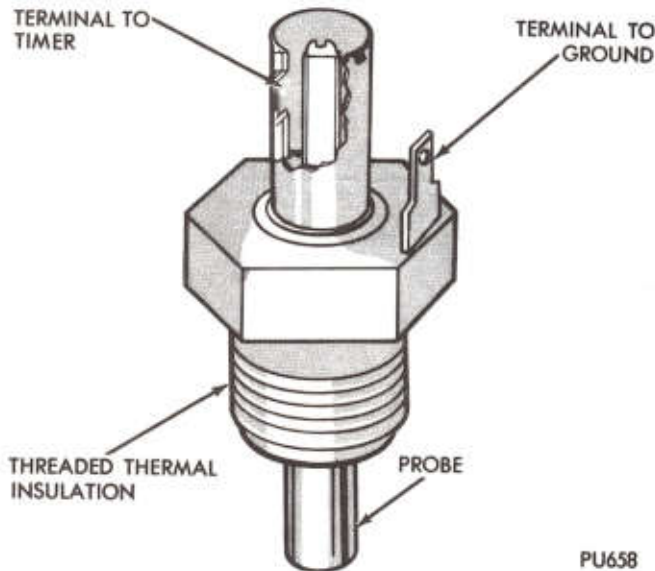


Fig. 2—Charge Temperature Switch

CHARGE TEMPERATURE SWITCH (CTS) (Fig. 2)

The CTS is installed in the intake manifold No. 8 runner on 5.9L 4V light duty eight cylinder engines. When the intake charge (air fuel mixture) temperature is below approximately 60°F (16°C), the CTS will be closed allowing no EGR time function and no EGR valve operation.

The CTS will be open when the intake charge temperature is above approximately 60°F, thus allowing the EGR timer to time out and the EGR valve to operate.

The maximum tightening torque for the CTS is 60 inch-pounds (6.8 N-m). Over tightening the CTS will break off the nylon threads in the intake manifold.

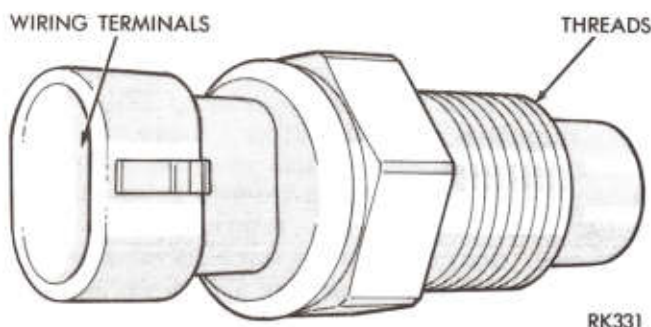


Fig. 3—Coolant Temperature Sensor

COOLANT TEMPERATURE SENSOR 3.9L AND 5.2L (Fig. 3)

This sensor is located in the water passage to monitor engine temperature. The sensor signals the SMEC when to operate the air switching, EGR and spark advance systems. (Torque to 20 ft. lbs.)

COOLANT VACUUM SWITCH FIVE (5) PORT (Fig. 4)

The five port coolant switch combines the functions of the coolant controlled engine vacuum switch (CCEVS) and the three port coolant vacuum switch (CVS3P).

The valve, as shown, can best be described as two entirely separate switches.

One half of the part behaves as a two port CCEVS. In this application, the switch is normally closed up to 150°F, above this temperature, the switch opens subsequently supplying vacuum to open the EGR valve.

The other half of the part behaves as a CVS3P. In this application idle, full distributor advance is ensured by supplying manifold vacuum to the distributor below 150°F.

Operation Below 150°F

Below 150°F, trapped manifold vacuum to the distributor ensures full spark advance at idle. During cold acceleration, distributor timing slowly returns to normal. This feature was added for cold weather driveability.

Operation Above 150°F

Above 150°F, the three port switch turns control of the spark advance over to the T.I.D.C. valve. Below 225°F - Carburetor vacuum to the distributor and above 225°F, manifold vacuum to the distributor for full spark advance. This reduces engine heat rejection and increases engine rpm and thus fan speed.

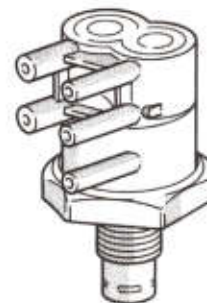


Fig. 4—Coolant Vacuum Switch Five (5) Port

SERVICE PROCEDURES

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TESTS OR ADJUSTMENT.

Exhaust Gas Recirculation (EGR) System

A failed or malfunctioning EGR system can cause engine spark knock, sags or hesitation, rough idle, and/or engine stalling. To assure proper operation of the EGR system all passages and moving parts must be free from plugging or sticking as a result of deposits. It is also important for the entire system to be free from leaks. Any hoses or components found to be leaking should be replaced.

Inspect all hose connections between carburetor, throttle body, intake manifold, EGR Control valve, EGR Solenoid. Replace any melted or cracked nylon lines or split rubber elbows in the vacuum harness. Any vacuum hoses or components found to be leaking should also be replaced.

Proper operation of the EGR System can be checked with the following tests:

EGR System Test

(1) Engine should be warmed up, running at normal idle speed, and with parking brake on.

(2) Allow the engine to idle in neutral with the carburetor throttle closed, then quickly accelerate engine speed to approximately 2,000 RPM, watching carefully the groove (movement indicator) on the EGR valve stem. (Fig. 5)

(3) Movement of the valve stem during the period of acceleration should be visible by observing a change in relative location of the groove on the stem. This indicates that the control system is functioning correctly, and the EGR Gas Flow Test can then be performed.

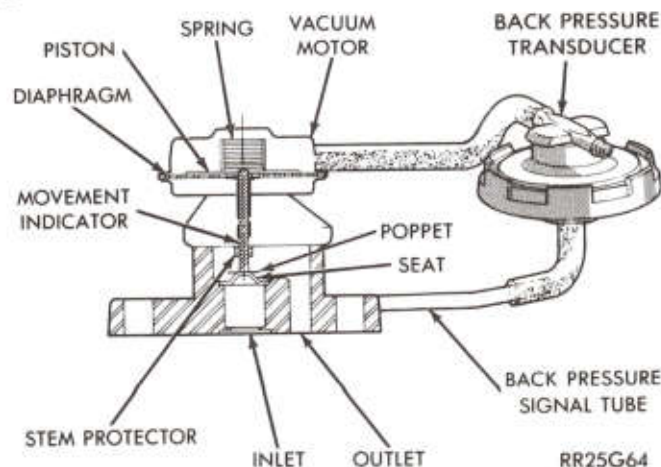


Fig. 5—EGR and Backpressure Transducer Assembly

(4) If no movement of the valve stem is visible, the problem should be diagnosed using the test procedure described under "EGR DIAGNOSIS" in this Group.

EGR Gas Flow Test

(1) Connect tachometer to engine.

(2) Remove vacuum hose (or rubber elbow) from EGR valve and connect Tool C-4207 (or hand vacuum pump) to valve vacuum motor nipple.

(3) Start engine and slowly apply vacuum to EGR valve vacuum motor.

(4) Engine RPM should drop as vacuum reaches 3 to 5 inches Hg and continue to drop as more vacuum is applied (engine may even stall). This means EGR gas is flowing through the system.

(5) Successful completion of this EGR Gas Flow Test and the previous Control System Test indicates a fully-functional EGR system.

(6) If engine speed does not drop, a defective EGR valve or plugged EGR passage is indicated. Remove the EGR valve and inspect as described below. Intake manifold passages should be checked for deposits and cleaned if necessary.

EGR Valve Service 5.9L Engine

The EGR valve should be inspected for deposits with particular attention to the poppet and seat area (Fig. 6). If deposits exceed a thin film condition, the EGR valve should be cleaned. Cleaning is aided by applying a liberal amount of manifold heat control valve solvent, or equivalent, to the poppet and seat area and allowing the deposits to soften. The deposits may be removed by opening the valve using an external vacuum source and scraping the deposits from the seat and poppet using a suitable sharp edge

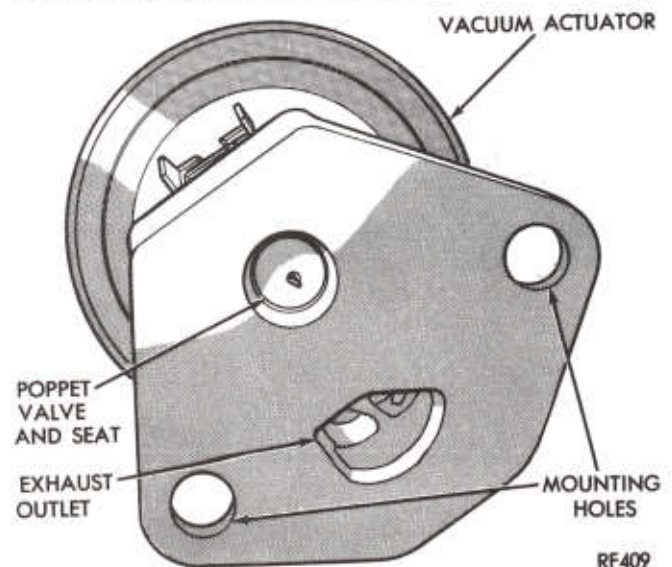


Fig. 6—EGR Control Valve (Bottom View)

tool. Do not scratch the valve seat or dislodge the poppet from the stem. If wear of the stem or other moving components is noted, the valve should be replaced. **Extreme care should be exercised during the cleaning operation to prevent spilling of solvent on the valve diaphragm, as this may cause diaphragm failure. Do not push on diaphragm to operate valve, use vacuum source only.**

Defective EGR control valves should be corrected by removing accumulated deposits or by replacement. Use a new flange gasket between the valve and manifold after any valve removal.

EGR Valve Service 3.9L and 5.2L Engines (Fig. 7)

Removal

- (1) Disconnect vacuum hose to EGR Valve/Transducer Assembly.
- (2) Remove 2 attaching screws.
- (3) Remove EGR valve, remove gasket and discard. Clean intake manifold surface and check for cracks.

Installation

- (1) Place new EGR gasket on intake manifold.
- (2) Install EGR valve using mounting screws and torque nuts to 200 in. lbs. (23 N·m).
- (3) Reconnect vacuum hose to valve/transducer assembly.

EGR Valve Service 5.9L Engine

Removal

- (1) Disconnect vacuum hose to EGR Valve.
- (2) Remove 2 attaching screws.
- (3) Remove EGR valve, remove gasket and discard. Clean intake manifold surface and check for cracks.

Installation

- (1) Place new EGR gasket on intake manifold.
- (2) Install EGR valve using mounting screws and torque nuts to 200 in. lbs. (23 N·m).
- (3) Reconnect vacuum hose to valve.

EGR DIAGNOSIS

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING

IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TESTS.

Condition	Possible Cause	Correction
EGR VALVE STEM DOES NOT MOVE ON SYSTEM TEST.	(a) Cracked, leaking, disconnected or plugged hoses. (b) Defective EGR valve, ruptured diaphragm or valve stem frozen.	(a) Verify correct hose connections and leak check to confirm that all hoses are open. If defective hoses are found, replace hose harness. (b) Disconnect hose harness from EGR valve. Connect external vacuum source, 10 inches Hg or greater, to valve diaphragm. If no valve movement occurs, replace valve. If valve opens, approximately 1/8 inch (3mm) travel, pinch off supply hose to check for diaphragm leakage. Valve should remain open 30 seconds or longer. If leakage occurs, replace valve.
EGR VALVE STEM DOES NOT MOVE ON SYSTEM TEST, OPERATES NORMALLY ON EXTERNAL VACUUM SOURCE.	I. VENTURI VACUUM CONTROL SYSTEM (a-1) Defective CTS	(a-1) Bypass EGR solenoid and connect amplified venturi vacuum directly to EGR valve. If normal operation of EGR stem is observed, further diagnosis of the CTSEGR system is required. With engine warmed up, remove wire from center terminal of the CTS. Wait 90 seconds. If EGR valve operates, replace CTS. To check CTS with engine cold, remove both wires from the CTS. Use an ohmmeter to check the resistance of the switch. If the resistance is greater than 10 ohms, replace the switch. If the resistance is not greater than 10 ohms, check the continuity of the ground circuit.

Condition	Possible Cause	Correction
EGR VALVE STEM DOES NOT MOVE ON SYSTEM TEST, OPERATES NORMALLY ON EXTERNAL VACUUM SOURCE. (Cont'd)	(a-2) Defective CVS5P valve.	(a-2) Bypass valve so that amplifier is connected directly to EGR valve. If normal operation of EGR valve stem is restored, replace CVS5P valve.
	(b) Defective coolant temperature sensor.	(b) To check coolant temperature sensor, remove wiring connector from coolant temperature sensor. Use an ohmmeter to check resistance of sensor. Ohmmeter should read as follows: 382,000 to 22,000 ohms at (-40° to 20° F) 36,000 to 3,300 ohms at (50° to 100° F) 3,900 to 176 ohms at 140° to 245° F.) If resistance is okay, repair wires between computer and sensor for open or short. If resistance is not okay, replace coolant temperature sensor.
	(c) Defective EGR vacuum control solenoid.	(c-1) Engine running. Connect voltmeter to gray wire of EGR vacuum solenoid and ground. With engine temperature below 50° F-4 BBL. voltmeter should read 0-1 volts. Voltage above 1 volt, perform next test. (c-2) Turn the engine off. Disconnect the computer 12 way connector. Connect a voltmeter to cavity No. 7 of the 12 way connector and ground. Turn the ignition switch to the run position. Voltmeter should read within 1 volt of battery voltage. If voltage is okay, replace computer. 0 volt repair the wire of cavity No. 7 for an open circuit to the EGR vacuum solenoid. (c-3) Engine running. Connect voltmeter to blue wire of EGR vacuum solenoid. Voltmeter should read within one volt of battery voltage. Voltage ok replace EGR vacuum solenoid. 0 volts repair wire harness to ignition switch for an open circuit.
	(d) Defective vacuum control unit (amplifier).	(d) Venturi Vacuum Control System: Remove venturi signal hose from nipple on carburetor. With engine operating at idle, apply a vacuum of one to two inches Hg to venturi signal hose. Engine speed should drop a minimum of 150 RPM and EGR valve stem should visibly move $1/8$ inch (3mm) or more. If this does not occur, replace vacuum control unit.
	(e) Plugged carburetor venturi signal passage.	(e) If vacuum control unit (amplifier), operates normally in previous test, plugged vacuum tap to carburetor venturi is indicated. Use suitable carburetor solvent to remove deposits from passage and use light air pressure to verify that passage is clear.
ENGINE WILL NOT IDLE, DIES OUT ON RETURN TO IDLE OR IDLE IS VERY ROUGH OR SLOW.	(a) Control system defective—EGR valve open.	(a) Disconnect hose from EGR valve and plug hose—recheck idle. If satisfactory, replace vacuum control unit (amplifier).

Condition	Possible Cause	Correction
WEAK WIDE OPEN THROTTLE PERFORMANCE.	(b) High EGR valve leakage in closed position.	(b) If vacuum hose removal does not correct, remove EGR valve and inspect to insure poppet is seated. Clean deposits if necessary, or replace valve if found defective.
	(a) Defective vacuum control unit (amplifier).	(a) Disconnect hose from EGR valve and plug the hose. Road test the vehicle, if performance is restored, replace vacuum control unit.

Do not use drills or wires to clean carburetor control passages for either type of control system as calibration of precision control orifices may be altered resulting in unsatisfactory vehicle operation.

EGR DIAGNOSIS

3.9L AND 5.2L TBI VEHICLES ONLY

NOTE: ALL TESTS MUST BE MADE WITH FULLY WARM ENGINE RUNNING CONTINUOUSLY FOR AT LEAST TWO MINUTES

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TESTS OR ADJUSTMENTS.

Condition	Possible Cause	Correction
EGR VALVE STEM DOES NOT MOVE ON SYSTEM TEST.	(a) Cracked, leaking, disconnected or plugged hoses.	(a) Verify correct hose connections and leak check and confirm that all hoses are open. If defective hoses are found, replace hose harness. (b) Disconnect hose harness from EGR vacuum transducer and connect auxiliary vacuum supply. Raise engine rpm to 2000 rpm and hold. Apply 10" Hg continuous vacuum while checking valve movement. If no valve movement occurs, replace valve/transducer assy. If valve opens (approx. 3mm or 1/8" travel), apply vacuum to vacuum motor nipple and hold supply vacuum to check for diaphragm leakage. Valve should remain open 30 seconds or longer. If leakage occurs, replace valve/transducer assy. If valve is satisfactory, check control system.
EGR VALVE STEM DOES NOT MOVE ON SYSTEM TEST. OPERATES NORMALLY ON EXTERNAL VACUUM SOURCE.	(a) Defective control system—Plugged passages.	(a) Remove throttle body and inspect manifold vacuum source and associated passage in throttle body. Use suitable solvent to remove deposits and check for flow with light air pressure. Normal operation should be restored to EGR system. (b) Check EGR Solenoid for correct operation.
ENGINE WILL NOT IDLE. DIES OUT ON RETURN TO IDLE OR IDLE IS VERY ROUGH OR SLOW.	(a) High EGR valve leakage in closed position.	(a) If removal of vacuum hose from EGR valve does not correct rough idle, remove EGR valve/transducer assy, and inspect to insure that poppet is seated. Replace valve/transducer if defective.

NOTE: DO NOT ATTEMPT TO CLEAN BACK-PRESSURE EGR VALVE. REPLACE ENTIRE VALVE/TRANSDUCER ASSEMBLY IF NECESSARY.

HEATED OXYGEN SENSOR (O₂ SENSOR) (FIGS. 7 AND 8)

The Oxygen Sensor (O₂ Sensor) is a device which produces an electrical voltage when exposed to the oxygen present in the exhaust gasses. The sensor is electrically heated internally for faster switching when engine is running. When there is a large amount of oxygen present (lean mixture), the sensor produces a low voltage. When there is a lesser amount present (rich mixture) it produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch. The voltage is supplied to the Single Module Engine Controller (SMEC) which adjusts the fuel delivery accordingly.

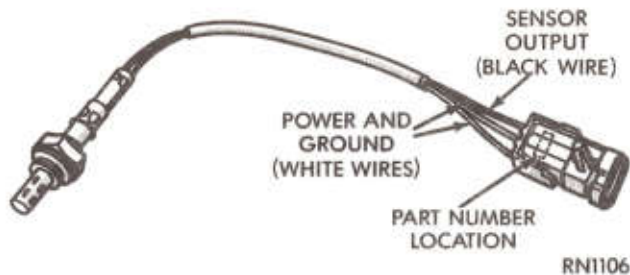


Fig. 7—Heated Oxygen Sensor 5.2L

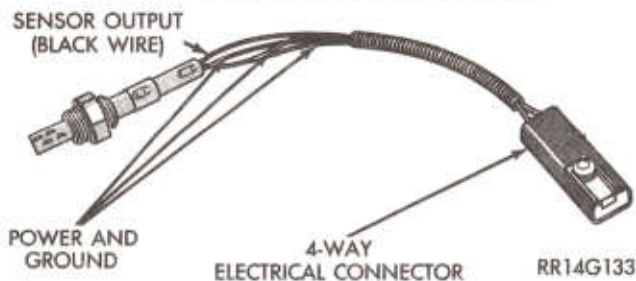


Fig. 8—Heated Oxygen Sensor 3.9L

Heated Oxygen Sensor (O₂ Sensor) Service (Figs. 9, 10 and 11)

Disconnect engine harness lead from Sensor.
CAUTION: Care should be exercised so that no pulling force is put on sensor wire. Use care in working around sensor as the exhaust system may be extremely hot.

The oxygen sensor is located in the exhaust manifold on 5.2L engines (Fig. 9) and in the exhaust "Y" pipe on the left side of the vehicle on 3.9L engines. (Fig. 11) Remove sensor using Tool C-4907. For Heated O₂ Sensors. When the sensor is removed, the exhaust manifold threads must be cleaned with an 18mm × 1.5 × 6E tap. If the same sensor is to be reinstalled, sensor threads must be coated with an anti-seize compound such as Loctite 771-64 or equivalent. New

sensors are packaged with compound on the threads and no additional compound is required. Sensors must be torqued to 27 N·m (20 foot pounds).

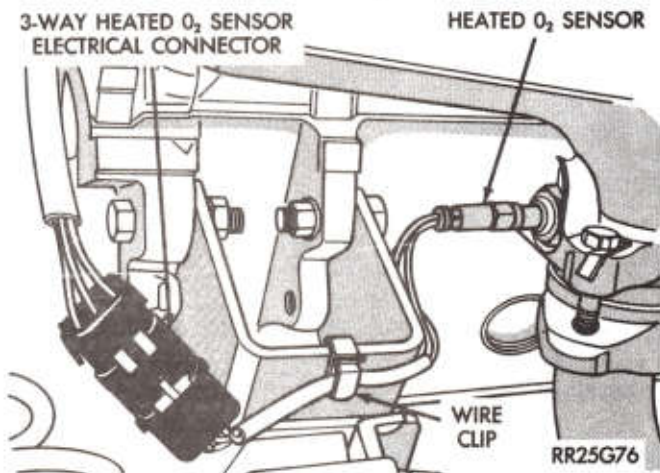


Fig. 9—Heated Oxygen Sensor Location 5.2L Engine

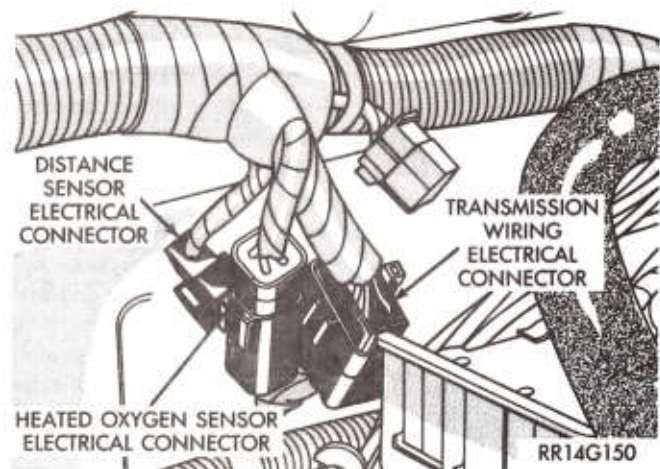


Fig. 10—Heated Oxygen Sensor Electrical Connection 3.9L Engine

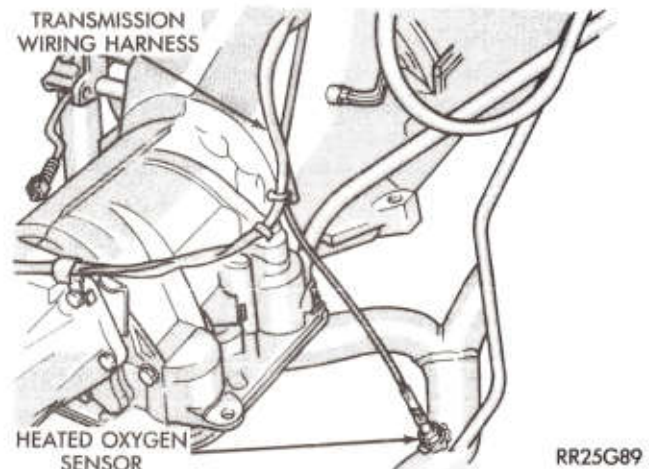


Fig. 11—Heated Oxygen Sensor Location 3.9L Engine

AIR INJECTION SYSTEM

INDEX

	Page		Page
Air Injection Pump	14,17	Dual Air Pump	18
Installation	18	Installation	19
Removal	17	Removal	18
Air Pump Diagnosis	16	General Information	14
Air Switching System	14	Power Heat Control Valve	15,20
Centrifugal Filter Fan		Installation	20
Installation	19	Removal	20
Removal	19	Service Procedures	17
Check Valve (Air Injection Tube)	15,20	Switch/Relief Valve	15,20
Installation	20	Installation	20
Removal	20	Removal	20
Diverter Valve	15,20		
Installation	20		
Removal	20		

GENERAL INFORMATION

The air pump air injection system consists of a belt-driven air pump, an air control valve (either a diverter valve, relief or a switch/relief valve), rubber hoses, check valves to protect the hoses, and injection tubes and other components from hot exhaust gases. This system adds a controlled amount of air to the exhaust gases aiding the reduction of hydrocarbons and carbon monoxide in the exhaust stream.

The system is designed so that the air injection will not interfere with the ability of the EGR system to control NO_x emissions. Air is injected at the exhaust ports for a short time during engine warm-up. The air flow is then switched to a point downstream where it will assist the oxidation process in the catalyst but not interfere with exhaust gas recirculation. The switching is controlled by a vacuum solenoid.

Air Switching System

3.9L and 5.2L Engines - When the vehicle is started the air switching solenoid is energized and switches air upstream. When the oxygen feedback system goes to closed loop, the air will be switched to downstream until an open loop idle condition takes place. Open loop idle condition occurs when the vehicle speed is less than three miles-per-hour, throttle switch is closed and approximately 5 second have elapsed when both conditions are met.

Air Injection Pump (Fig. 1)

The belt driven air pump is mounted on the front of the engine with power take-off at the crankshaft pulley. Intake air passes through a centrifugal fan at the front of the pump, where foreign materials are separated from the air by centrifugal force. Air is delivered to the air injection manifold and check valve tube assembly by a rubber hose through the diverter valve and switching valve. Hoses are secured to all fittings by clamps.

The air injection system is not completely noiseless. Under normal conditions, noise rises in pitch as engine speed increases. To determine if excessive noise is the fault of the air injection system, disconnect the drive belt and operate the engine. If noise now does not exist, proceed with diagnosis.

The only serviceable component of this pump is the centrifugal fan filter (Fig. 1). Do not assume the pump is defective if it squeaks when turned by hand.

DO NOT LUBRICATE PUMP. Wipe all oil off of pump housing. Oil in the pump will cause rapid deterioration and failure.

If the engine or underhood compartment is to be cleaned with steam or high pressure detergent, the centrifugal fan filter should be masked off to prevent liquids from entering the pump.

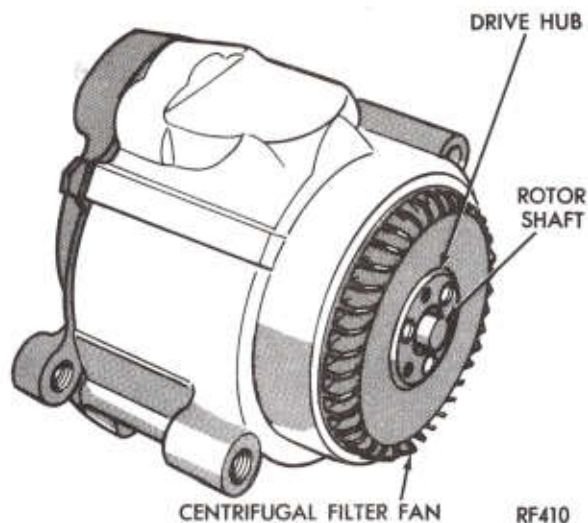


Fig. 1—Air Injection Pump

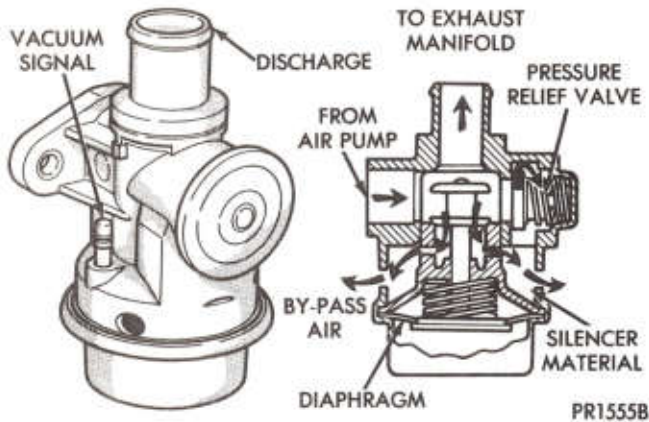


Fig. 2—Diverter Valve

Diverter Valve

The purpose of the diverter valve (Fig. 2) is to prevent backfire in the exhaust system during sudden deceleration.

Sudden throttle closure at the beginning of the deceleration temporarily creates an air-fuel mixture too rich to burn. This mixture becomes burnable when it reaches the exhaust area and combines with injector air. The next firing of the engine will ignite this air-fuel mixture. The diverter valve senses the sudden increase in intake manifold vacuum causing the valve to open, allowing air from the air pump to pass through the valve and silencer to the atmosphere.

A pressure relief valve, incorporated in the same housing as the diverter valve, controls pressure within the system by diverting excessive pump output at higher engine speeds to the atmosphere through the silencer.

Switch/Relief Valve

The purpose of the switch/relief valve (Fig. 3) is twofold. First of all, the valve directs the air injection flow to either the exhaust port location or to the downstream injection point. In addition, the valve regulates, by controlling the output of the air pump at high speeds. When the pressure reaches a certain level, some of the output is vented to the atmosphere through the silencer.

Initially, air is injected at the upstream location as close to the exhaust valves as possible. As the engine temperature increases, exhaust gas recirculation will begin functioning. When this happens, the air injection point must be switched to the downstream location for the best possible operation.

The switch/relief valve is controlled by manifold vacuum and a vacuum solenoid. When the engine is cold, a manifold vacuum signal is sent to the

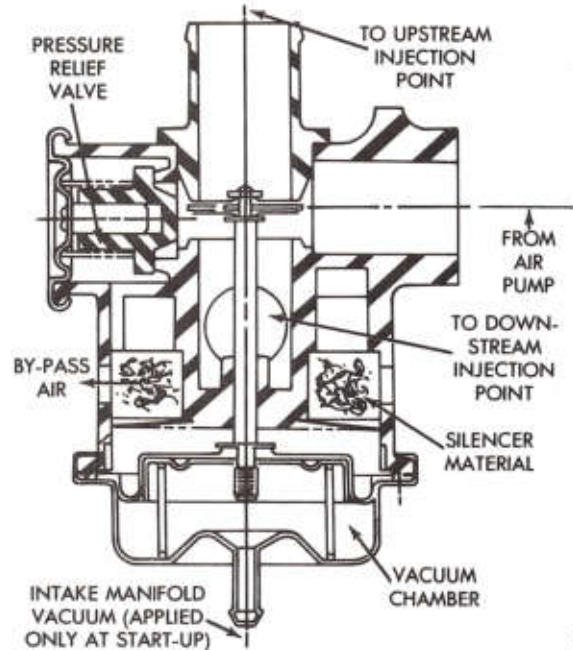


Fig. 3—Switch/Relief Valve

switch/relief valve and the valve directs air injection to the exhaust port location.

When engine temperature is hot the solenoid shuts off the manifold vacuum signal to the switch/relief valve. A bleed orifice in the solenoid allows the vacuum signal to go to zero. Without a vacuum signal, the valve switches most of the air pump air to the downstream location.

Check Valve (Air Injection Tube)

A check valve is located in the injection tube assemblies that lead to the exhaust manifolds on the eight cylinder engine and the cylinder head and exhaust pipe on the six cylinder engine. This valve has a oneway diaphragm which prevents hot exhaust gases from backing up into the hose and pump. This valve will protect the system in the event of pump belt failure, abnormally high exhaust system pressure, or air hose ruptures.

Power Heat Control Valve

The power heat valve, located between the right exhaust manifold and exhaust pipe, is a vacuum operated device which directs the majority of exhaust gas flow through the left-hand exhaust manifold.

A electrical solenoid controls the manifold vacuum signal necessary to activate the heat valve. At coolant temperatures below a predetermined level, manifold vacuum is applied to the heat valve and all exhaust gas flow is directed to the left-hand exhaust manifold. Above this temperature no vacuum signal is applied to the heat valve and exhaust gas flow proceeds through both the right-hand and left-hand manifolds.

AIR PUMP DIAGNOSIS

WARNING: BE SURE TO APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING IDLE CHECK OR ADJUSTMENT, OR ANY ENGINE RUNNING TEST.

Condition	Possible Cause	Correction
EXCESSIVE BELT NOISE	(a) Loose belt. (b) Seized pump.	(a) Tighten belt (see Group 7 "Cooling System"). (b) Replace pump.
EXCESSIVE PUMP NOISE, CHIRPING	(a) Insufficient break-in.	(a) Recheck for noise after 1000 miles (1600 km) of operation.
EXCESSIVE PUMP NOISE CHIRPING, RUMBLING, OR KNOCKING	(a) Leak in hose. (b) Loose hose. (c) Hose touching other engine parts. (d) Diverter valve inoperative. (e) Check valve inoperative. (f) Pump mounting fasteners loose. (g) Pump failure.	(a) Locate source of leak using soap solution and correct. (b) Reassemble and replace or tighten hose clamp. (c) Adjust hose position. (d) Replace diverter valve. (e) Replace check valve. (f) Tighten mounting screws as specified. (g) Replace pump.
NO AIR SUPPLY (ACCELERATE ENGINE TO 1500 RPM AND OBSERVE AIR FLOW FROM HOSES. IF THE FLOW INCREASES AS THE RPM'S INCREASE, THE PUMP IS FUNCTIONING NORMALLY. IF NOT, CHECK POSSIBLE CAUSE.)	(a) Loose drive belt. (b) Leaks in supply hose. (c) Leak at fitting(s). (d) Diverter valve leaking. (e) Diverter valve inoperative. (f) Check valve inoperative.	(a) Tighten to specifications. (b) Locate leak and repair or replace as required. (c) Tighten or replace clamps. (d) If air is expelled through diverter exhaust with vehicle at idle, replace diverter valve. (e) Usually accompanied by backfire during deceleration. Replace diverter valve. (f) Replace check valve.
AIR SUPPLY UPSTREAM WITH NO VACUUM TO SWITCH/RELIEF VALVE	(a) Defective air switching valve. (b) Defective air switching vacuum solenoid.	(a) Engine running for more than 4 minutes. Disconnect vacuum hose from air switching valve and connect a vacuum gauge to it. Vacuum gauge should read 0. Vacuum okay, replace air switching valve. Vacuum above 0, Perform Next Test. (b) (1) Engine running for more than 2 minutes. Connect voltmeter to green wire of air switching solenoid and ground. Voltmeter should read within one volt of battery voltage. Voltage okay, replace vacuum solenoid assembly. 0-1 volts, Perform Next Test. (2) Turn the engine off. Disconnect the computer 12 way connector. Connect a voltmeter to cavity No. 12 of the 12 way connector and ground. Turn the ignition switch to the run position. Voltmeter should read within one volt of battery voltage. Voltage okay, replace computer. Voltage still 0-1, repair green wire for a short to ground.

SERVICE PROCEDURES

For satisfactory emission control and engine durability, it is important that the air pump be operating at all times (except when performing tests). For proper operation of the air pump, it is necessary that the air pump drive belt be in good condition and adjusted to the specified tension. Check the condition of the air pump belt and adjust the tension according to specifications. See "Cooling System" Group 7 for intervals.

Servicing of the air pump is limited to replacement of the centrifugal fan filter or the entire pump. Do not disassemble pump for any reason. **Do not clamp pump in vise or use a hammer or pry bar on pump housing.**

AIR INJECTION PUMP

3.9L, 5.2L and 5.9L Engines (Figs. 4, 5 and 6)

Removal

(1) Remove air hose from air pump outlet elbow, or control valve.

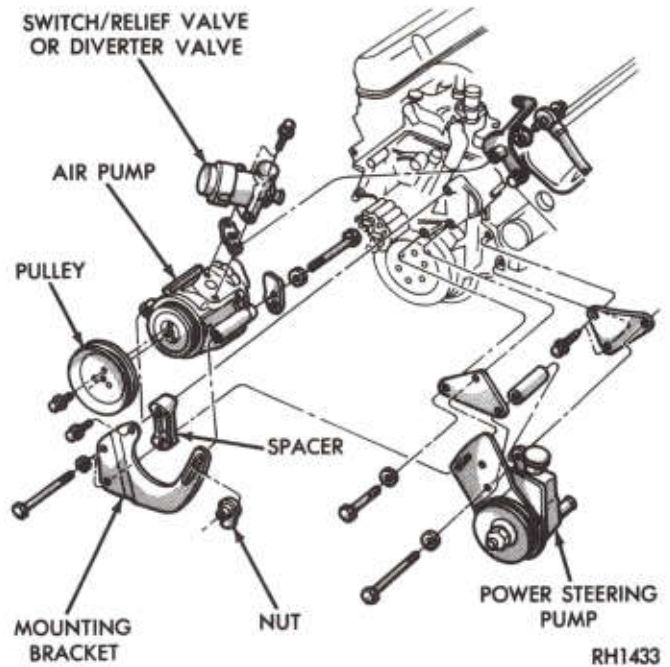


Fig. 4—Air Pump Mounting 3.9L, 5.2L, and 5.9L

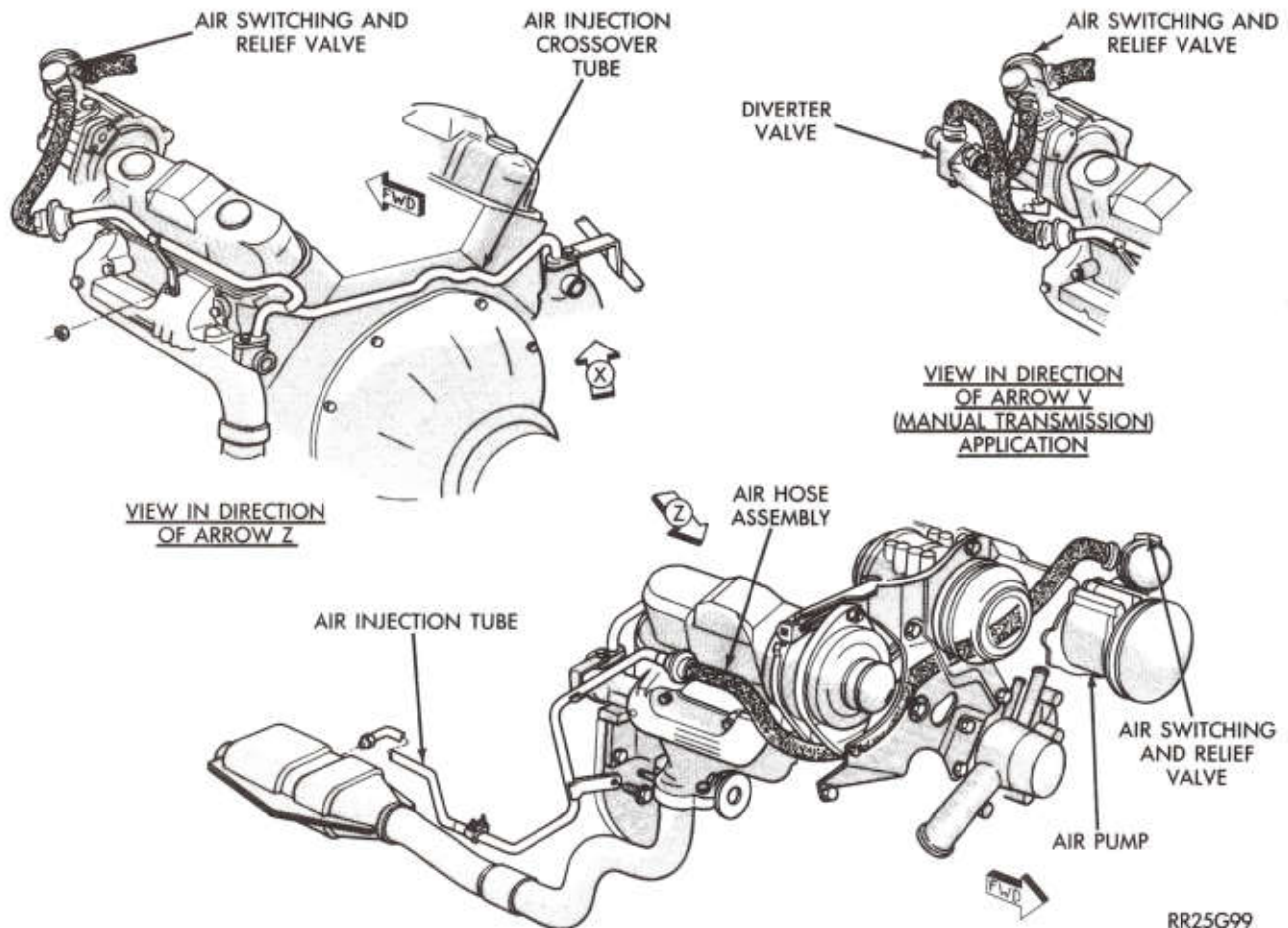


Fig. 5—Air Injection System 3.9L

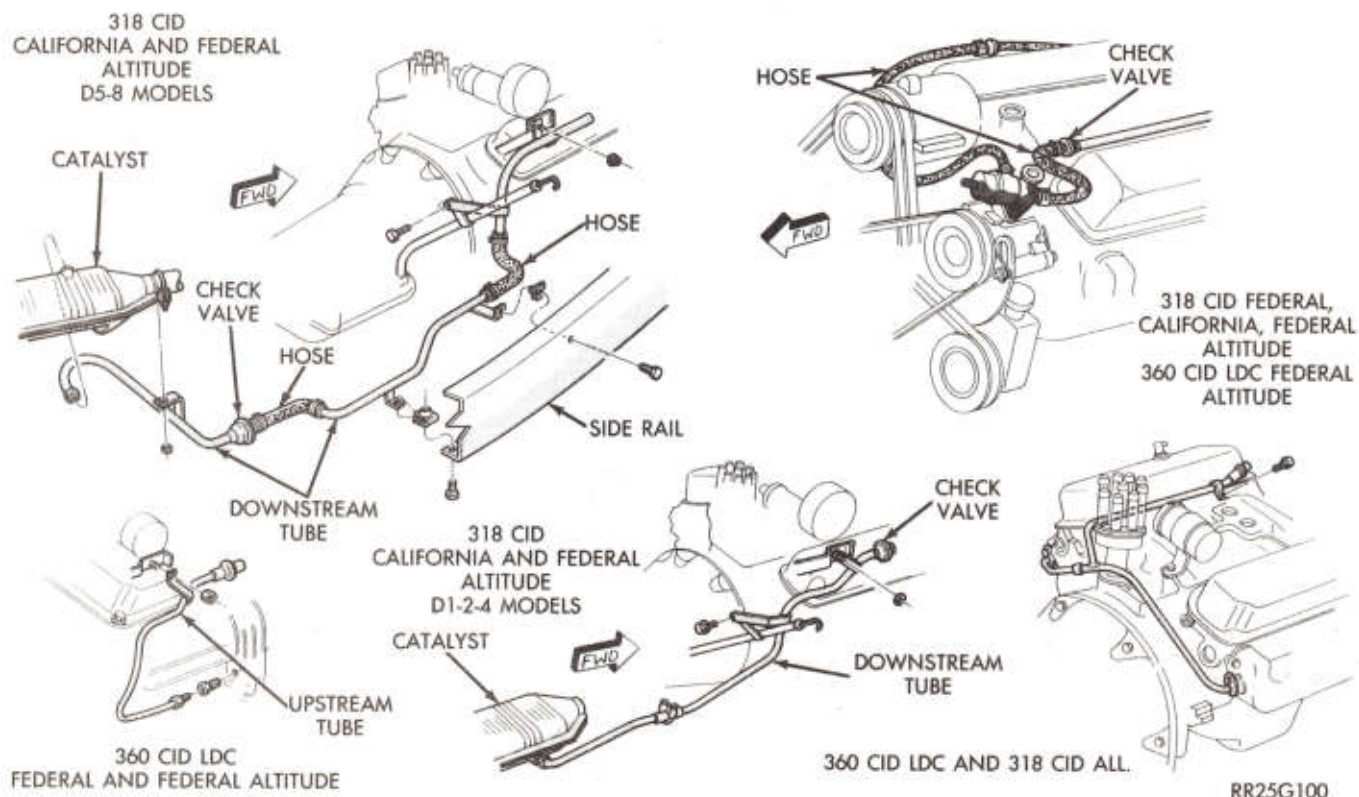


Fig. 6—Air Injection System 5.2L and 5.9L

(2) Loosen air pump pivot and adjusting bolts and remove belt.

(3) Remove pivot and adjusting bolts from pump brackets and remove pump pulley and brackets as an assembly.

(4) Remove air pump pulley, brackets and diverter valve, switch relief valve or outlet elbow from air pump.

Installation

(1) Install air pump pulley, diverter valve, switch/relief valve or outlet elbow and brackets on air pump. Use new gasket on pump flange. Tighten the air pump pulley screws to 95 inch-pounds (11 N·m) and outlet elbow screws to 95 inch-pounds (11 N·m) MAXIMUM and bracket attachment bolts to 30 foot-pounds (41 N·m) MAXIMUM.

(2) Position pump assembly on engine and install the air hose to the diverter valve, switch/relief valve or pump outlet elbow. Install pump pivot and adjusting bolts loosely.

(3) Install drive belt and adjust. See "Cooling System," Group 7. **Do not, under any conditions, pry on the housing.** Tighten mounting bolts to 30 foot-pounds (41 N·m).

DUAL AIR PUMP - 360 CID ENGINES (5.9L) (FIGS. 7 AND 8)

Removal

(1) Remove air hose from diverter valve on both upper and lower pumps.

(2) Loosen air pump pivot and adjusting bolts on

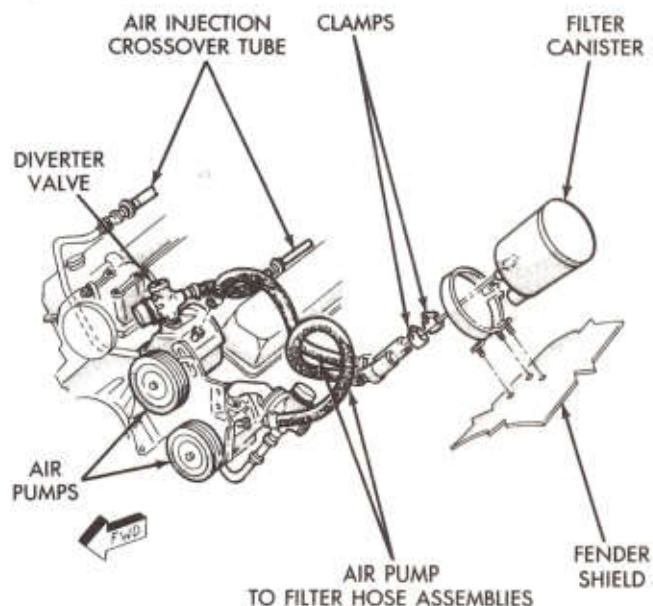


Fig. 7—Dual Air Pump Mounting 5.9L-4 Engine

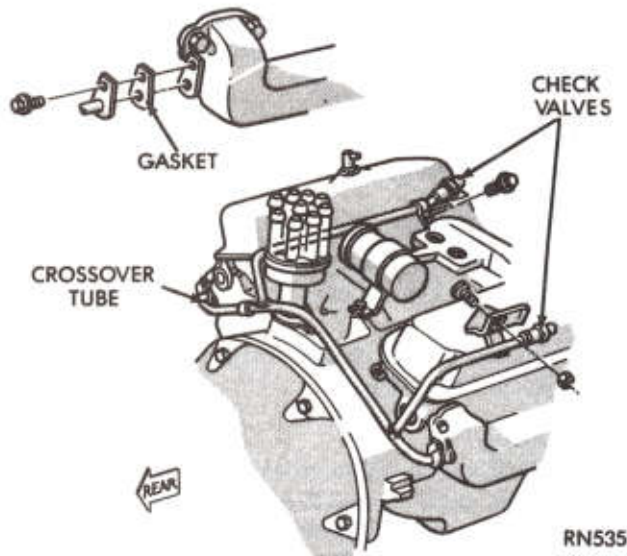


Fig. 8—Air Injection System 5.9L-4 Dual Air Pump

upper pump and remove belt.

(3) Remove air pump attaching bolts from lower pump and remove air pump, diverter valve, and adapter as an assembly.

(4) Remove air pump pivot and adjusting bolts from upper air pump and remove air pump and diverter valve as an assembly.

(5) Remove air pump pulleys, diverter valves, and adapters from pumps.

Installation

(1) Install air pump pulleys, diverter valves, and adapters to air pumps.

(2) Use new gasket on pump flange of lower pump. Tighten air pump pulley screws, diverter valve screws and adapter screws to 95 in. lbs. (11 N·m), MAXIMUM.

(3) Install lower air pump assembly and tighten attaching bolts to 30 ft. lbs. (41 N·m), MAXIMUM. Install air hose to diverter valve.

(4) Install upper air pump assembly and tighten pivot and adjusting bolts loosely. Install air hose to diverter valve.

(5) Install drive belt and adjust. See "Cooling System" Group 7. Do not under any conditions, pry on the housing. Tighten pivot and adjusting bolts to 30 ft. lbs. (41 N·m), MAXIMUM.

CENTRIFUGAL FILTER FAN

Removal

A damaged filter fan may be removed by inserting needle nose pliers between the plastic filter fins and breaking fan from hub. (Fig. 9). Care should be taken to prevent fragments from entering the air intake hole. Do not insert screwdriver blade between pump and filter. It is seldom possible to remove the fan

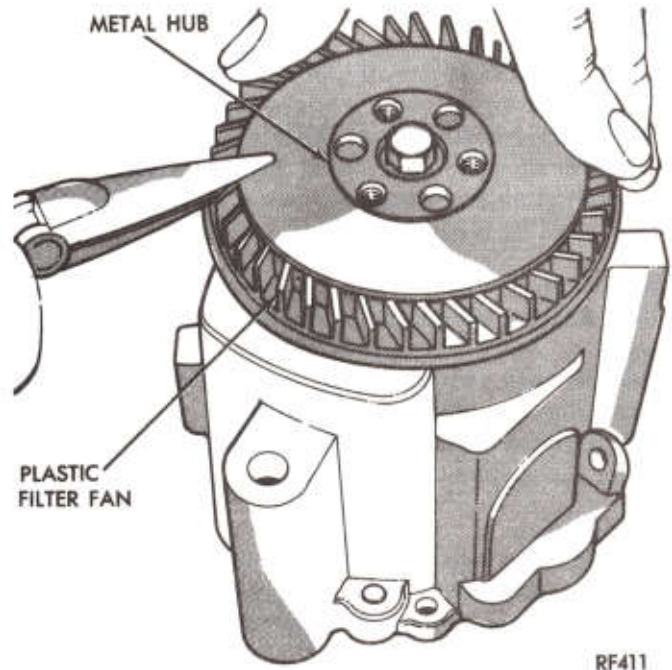


Fig. 9—Removing Centrifugal Filter Fan

without destroying it. Do not attempt to remove the metal drive hub.

Installation

Install the new filter fan by drawing it into position, using the pulley and bolts as tools. Draw the fan down evenly by alternately torquing the bolts, making certain that the outer edge of the fan slips into the housing (Fig. 10). A slight amount of interference with the housing bore is normal. Do not attempt to install a fan by hammering or pressing it on. After a new fan is installed, it may squeal upon initial operation until its O.D. sealing lip has worn in. This may require 20-30 miles (32 to 48 km) of operation.

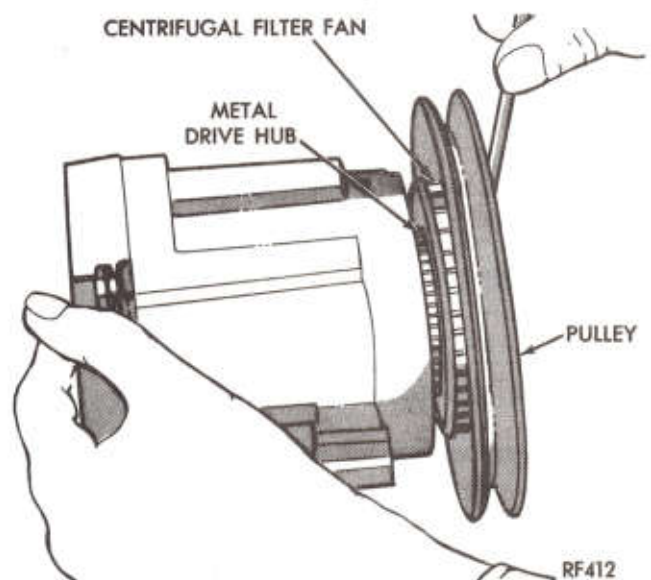


Fig. 10—Installing Centrifugal Filter Fan

DIVERTER VALVE

Servicing of the diverter valve is limited to replacement of the entire valve. Failure of the diverter valve will cause excessive noise. Either the relief valve or the diverter valve have failed if air escapes from the silencer at engine idle speed and entire valve assembly should be replaced.

Removal

- (1) Remove air and vacuum hoses from the diverter valve.
- (2) Remove two screws securing diverter valve to mounting flange and remove valve.
- (3) Remove gasket material from diverter valve and mounting surface.

Installation

- (1) Position new gasket on mounting surface.
- (2) Position diverter valve on mounting flange and secure with two screws. Tighten to 95 inch-pounds (11 N·m) MAXIMUM.
- (3) Reinstall air and vacuum hoses to diverter valve.

SWITCH/RELIEF VALVE

The switch/relief valve is not serviceable. If vacuum is applied to the valve and air injection is not upstream (to exhaust manifold crossover tube) or if air injection is both upstream and downstream, the valve is faulty and must be replaced. The relief valve is failed if air escapes from the silencer at engine idle speed.

Removal

- (1) Remove air and vacuum hoses from the switch/relief valve.
- (2) Remove the two screws securing the switch/relief valve to the mounting flange and remove valve.
- (3) Remove gasket material from the mounting surface and the switch/relief valve.

Installation

- (1) Position new gasket on mounting surface.
- (2) Position switch/relief valve on mounting surface and secure with screws. Tighten to 95 inch-pounds (11 N·m) MAXIMUM.
- (3) Install the air and vacuum hoses to the switch/relief valve.

CHECK VALVE (Injection tube assemblies)

The check valve is not repairable and if necessary, should be replaced with a new check valve. To determine if the valve has failed, remove the air hose from check valve inlet tube. If exhaust gas escapes from inlet tube, valve has failed and must be replaced. If exhaust manifold injection tube assembly joint is

leaking, remove injection tube assembly and replace gasket material. If tube nut joint is leaking retorque to 25-35 ft.-lbs. (34-47 N·m).

Removal (Non Threaded Type Check Valve)

- (1) Release clamp and disconnect air hose from check valve inlet.
- (2) Remove screws or tube nut securing injection tube to exhaust manifolds or exhaust pipe.
- (3) Remove the injection tube assembly from engine.
- (4) Remove gasket material from exhaust manifold and injection tube flanges.

Installation

- (1) Install new gaskets on exhaust manifold flanges and install new injection tube assembly. Tighten flange mounting and injection tube bracket screws to 100 inch-pounds (11.2 N·m). On tube nut joint assemblies, install tube nut and tighten to 25-35 ft.-lbs. (34-47 N·m).
- (2) Connect air hoses to check valve inlet and secure with clamps.

Removal (Threaded Type Check Valve)

- (1) Release clamp and disconnect air hose from the check valve inlet.
- (2) Unscrew the check valve from the injection tube assembly, using the hex at the threaded joint.

Installation

- (1) Install check valve on tube assembly. Tighten, using hex at threaded joint, to 25 ft. lbs. (34 N·m).
 - (2) Install air hose to the check valve inlet and tighten clamp.
- Removal of the lower tube assembly may require removal of the upper air pump and A/C compressor. Refer to sections 24 and 25.

POWER HEAT CONTROL VALVE

The purpose of this valve is to increase the flow of hot exhaust gases through the left-hand exhaust manifold which rapidly brings the mini-catalyst up to operating temperature. Remove the vacuum line from the power heat valve and apply 6" Hg. of vacuum to the valve. The valve should be fully closed. If not, replace the valve.

Removal

- (1) Disconnect exhaust pipe at exhaust manifold.
- (2) Disconnect vacuum line from power heat valve and remove valve assembly.

Installation

- (1) Place power heat valve in position and connect exhaust pipe to valve and exhaust manifold.
- (2) Connect vacuum line to valve.

EVAPORATIVE EMISSION CONTROLS

INDEX

	Page		Page
Charcoal Canister	21	Positive Crankcase Ventilation (PCV)	
Crankcase Inlet Air Filter	26	System Operation	25
Electric Bowl Vent Valve (5.9L Engine)	21	Pressure Vacuum Filler Cap	24
Emission, Adjustment and Routing (EAR) Label ..	21	Rollover Valve 5.9L Engine	24
Evaporation Control System	21	Rollover and Pressure Relief Valve	
Positive Crankcase Ventilation (PCV) System	24	(3.9L and 5.2L Engines)	24
Inspection and Service Procedure	25	Thermal Bowl Vent Valve (5.9L Engine)	21
		Vacuum Hose Routing Labels	22

EVAPORATION CONTROL SYSTEM

The function of the evaporation control system is to prevent the emissions of gasoline vapors from the fuel tank and carburetor into the atmosphere. When fuel evaporates in the carburetor float chamber or fuel tank, the vapors pass through vent hoses or tubes to single or dual canisters where they are temporarily held until they can be drawn into the engine when it is running.

The fuel bowls on all carburetors are vented internally. When the engine is shut off, a mechanical or electrical bowl vent valve opens allowing vapors to pass to the canister.

On fuel injected engines the vapors are drawn into the engine at idle as well as off idle. This system is called bi-level purge system, where there is a dual source of vacuum to remove fuel vapor from canister.

The source of vacuum at idle is a tee in the PCV system.

The charcoal canister is a feature on all models for the storage of fuel vapors from the fuel tank.

The hoses used in this system are specially manufactured and if replacement becomes necessary it is important to use only fuel resistant hose.

CHARCOAL CANISTER

Sealed, maintenance free, charcoal canisters are used on all engines and are located in the wheelwell area of the engine compartment. All engines except 5.9L-4V use one single canister; 5.9L-4V have dual canisters.

Fuel vapors are drawn from the vapor canister(s) into the engine through vacuum lines or hose to a carburetor or throttle body port or to a orificed tee in the PCV vacuum hose.

The canister purge is activated by applying a vacuum signal to the vapor canister; this vacuum is controlled by a CVS5P, or vacuum solenoid (depending on application).

THERMAL BOWL VENT VALVE (5.9L Engine)

The thermal bowl vent valve is located in the carburetor bowl vent line which connects to the carburetor at one end and to the vapor canister at the other end. The purpose of the thermal bowl vent valve is to improve cold startability at cold ambients. The thermal bowl vent valve is designed to close below a calibrated temperature, thereby, trapping fuel vapor within the carburetor bowl. These vapors will condense to liquid in the bowl, thus, providing more fuel and aiding the next cold start. Above a calibrated temperature, the thermal bowl vent valve is open, allowing fuel vapor from the carburetor bowl to flow to the vapor canister.

ELECTRIC BOWL VENT VALVE (5.9L Engine)

When engine is not running the electric bowl vent is deenergized, allowing fuel vapor to pass into the charcoal canister and to the inside of the air cleaner element.

During engine operation the electric bowl vent valve is energized, which allows the fuel bowl to vent inside the air cleaner element and not to the charcoal canister.

EMISSIONS, ADJUSTMENT AND ROUTING (EAR) LABEL

All vehicles are equipped with an **EAR** label (Figs. 5 thru 10) which is located in the engine compartment (Fig. 1). This label is permanently attached and cannot be removed without defacing information and destroying it. The label contains emission specifications and vacuum hose routings for the vehicle label is mounted on. If any difference exists between the specifications or vacuum hose routing shown on the label and those shown in the Service Manual, those shown on the label should be used. **The labels shown (Figs. 5 through 10) are for vacuum hose routing information only.**

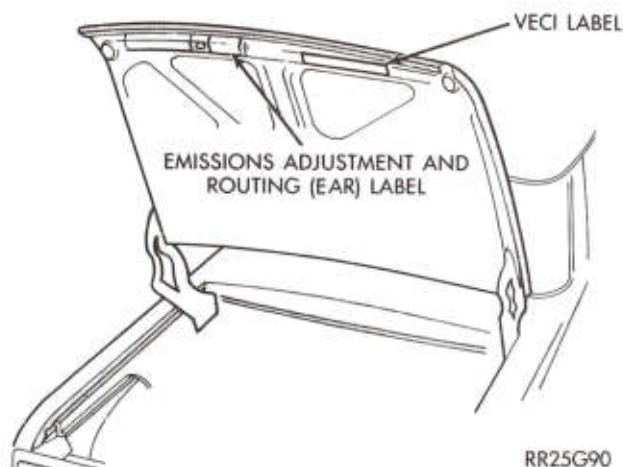


Fig. 1—Underhood Label Locations

VACUUM HOSE ROUTING LABEL

All vehicles are equipped with a vacuum hose routing label (Figs. 5 through 10) which is located in the engine compartment (Fig. 1). This label is permanently attached and cannot be removed without destroying it. All hoses must be connected and routed as shown on the label.

4300639			 CHRYSLER CANADA LTÉE	RENSEIGNEMENTS RELATIFS AU CONTRÔLE DES ÉMISSIONS	
	RÉGLAGES DU RALENTI*			LES RÉGLAGES QUI SERAIENT FAITS SELON D'AUTRES PROCÉDURES QUE CELLES DU MANUEL D'ENTRETIEN POURRAIENT ENFREINDRE LES LOIS FÉDÉRALES ET PROVINCIALES.	
	DISTRIBUTION AV P.H. MAN.10°AUTO.10° RÉGLAGE DU RALENTI EN tr/min MAN.750 (N)AUTO.750 (N)				
	*CONSULTEZ LE MANUEL D'ENTRETIEN POUR LES BONNES METHODES DE DIAGNOSTIC ET AUTRES RENSEIGNEMENTS PERTINENTS.				
	AVERTISSEMENT: SERREZ LE FREIN DE STATIONNEMENT POUR FAIRE L'ENTRETIEN OU LA RÉPARATION DU VÉHICULE				
			CYLINDRÉE 3,9 LITRES	BOUGIES ÉCARTEMENT 0,9 mm RN12YC	* LE CALAGE DE L'ALLUMAGE INITIAL ET LE MÉLANGE D'INJECTION D'ESSENCE ONT ÉTÉ PRÉRÉGLÉS À L'USINE. NEFFECTUEZ AUCUN RÉGLAGE LORS DE TRAVAUX D'ENTRETIEN RÉGULIERS.
					RR25G42

Fig. 2—Typical Vehicle Emission Control Information (VECI) Label (Canadian Only)

4300626	RÉGLAGES DU RALENTI*		MAN.	AUTO.	 CHRYSLER CANADA LTÉE	RENSEIGNEMENTS RELATIFS AU CONTRÔLE DES ÉMISSIONS			
	DISTRIBUTION AV P.H.		12°	12°		LES RÉGLAGES QUI SERAIENT FAITS SELON D'AUTRES PROCÉDURES QUE CELLES DU MANUEL D'ENTRETIEN POURRAIENT ENFREINDRE LES LOIS FÉDÉRALES ET PROVINCIALES.			
	RÉGLAGE DU RALENTI EN tr/min		800 (N)	800 (N)					
	RALENTI ACCÉLÈRE EN tr/min		1400 (N)	1400 (N)					
	PROPANE tr/min		840 (N)	900 (N)	CYLINDRÉE 5,9 LITRES		BOUGIES ÉCARTEMENT 0,9 mm RN12YC		* LE CALAGE DE L'ALLUMAGE INITIAL ET LE MÉLANGE DE RALENTI DU CARBURATEUR ONT ÉTÉ PRÉRÉGLÉS À L'USINE. NEFFECTUEZ AUCUN RÉGLAGE LORS DE TRAVAUX D'ENTRETIEN RÉGULIERS.
* CONSULTEZ LE MANUEL D'ENTRETIEN POUR LES BONNES MÉTHODES DE DIAGNOSTIC ET AUTRES RENSEIGNEMENTS PERTINENTS.									
AVERTISSEMENT: SERREZ LE FREIN DE STATIONNEMENT POUR FAIRE L'ENTRETIEN OU LA RÉPARATION DU VÉHICULE									

Fig. 3—Typical Canadian Heavy Duty Cycle Vehicle Emission Control Information (VECI) Label

RR25G79

ENGINE/VEHICLE EMISSION CONTROL INFORMATION																						
DISPL-MODEL	ENGINE FAMILY	EMISSION CONTROL SYSTEM	TIMING *	BASIC IGNITION TIMING AND CARBURETOR IDLE HAVE BEEN PRESET AT THE FACTORY. SEE THE SERVICE MANUAL FOR PROPER PROCEDURES AND OTHER ADDITIONAL INFORMATION. ADJUSTMENTS MADE BY OTHER THAN APPROVED SERVICE MANUAL PROCEDURES MAY VIOLATE FEDERAL AND STATE LAWS.																		
5.9 LITER ALL	JCC05.9AGE0	DUAL AP EGR	13° BTC	IDLE RPM *																		
				800																		
				PROPANE RPM *																		
				900																		
THIS ENGINE/VEHICLE CONFORMS TO U.S. EPA REGULATIONS APPLICABLE TO 1988 MODEL YEAR NEW HEAVY-DUTY ENGINES/VEHICLES UNDER THE SPECIAL PROVISIONS OF 40 CFR 86.1101-87 (sub part L).																						
 CHRYSLER MOTORS CORPORATION		4306798							EVAPORATIVE FAMILY JCC035.0GAB8							MAXIMUM NOMINAL FUEL TANK CAPACITY 35.0 GALLONS						
DATE OF MANUFACTURE		1987	JUL	AUG	SEP	OCT	NOV	DEC	1988	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	

RR25G80

Fig. 4—Typical Federal Heavy Duty Cycle Vehicle Emission Control Information (VECI) Label

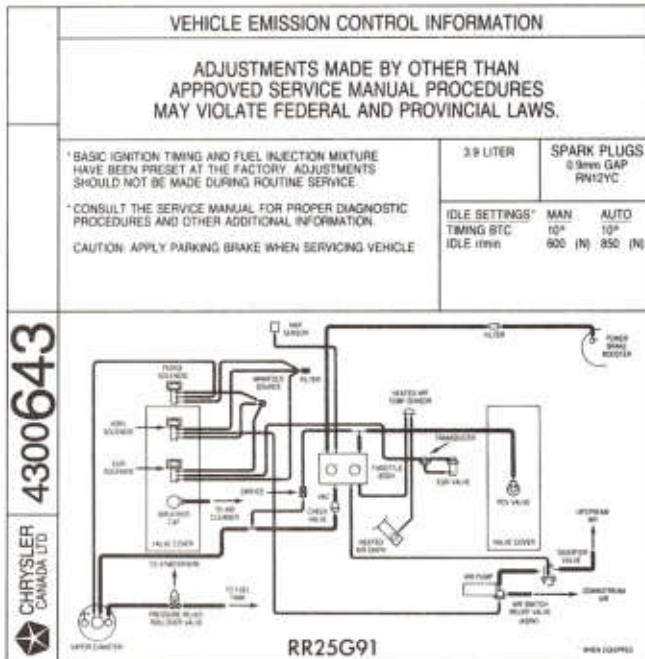


Fig. 5—Vacuum Hose Routing Label 3.9L Engines

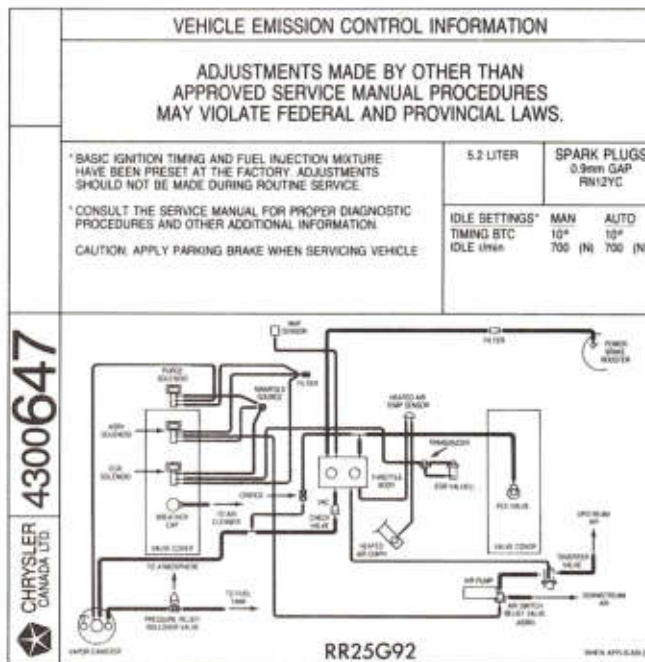


Fig. 6—Vacuum Hose Routing Label 5.2L Engines

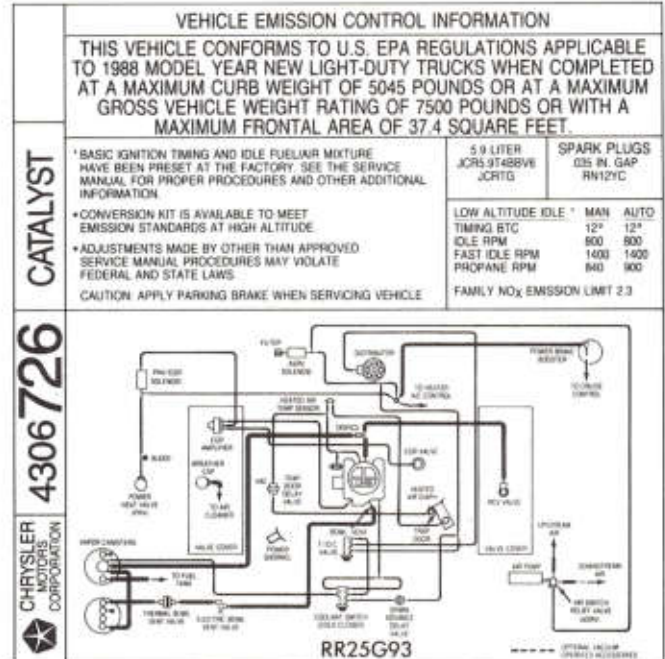


Fig. 7—Vacuum Hose Routing Label Light Duty Cycle Federal, Canadian and Altitude 5.9L-4 Engines

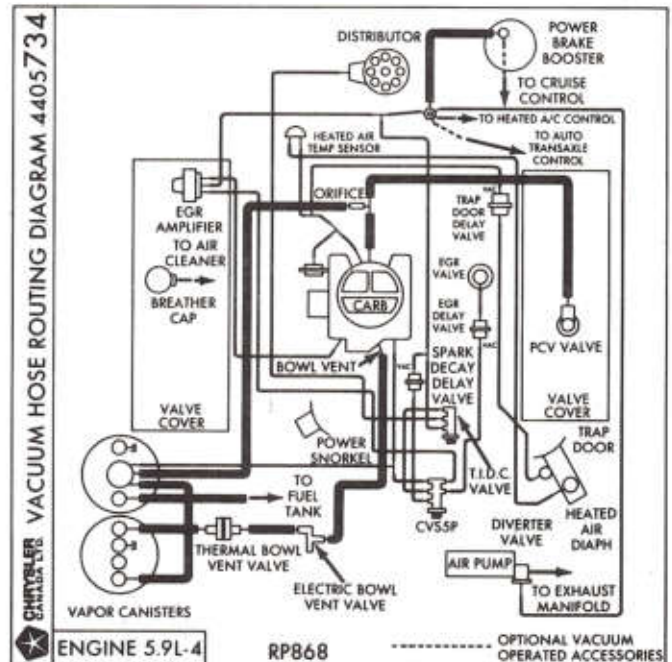


Fig. 8—Vacuum Hose Routing Label California 5.9L-4 Engines

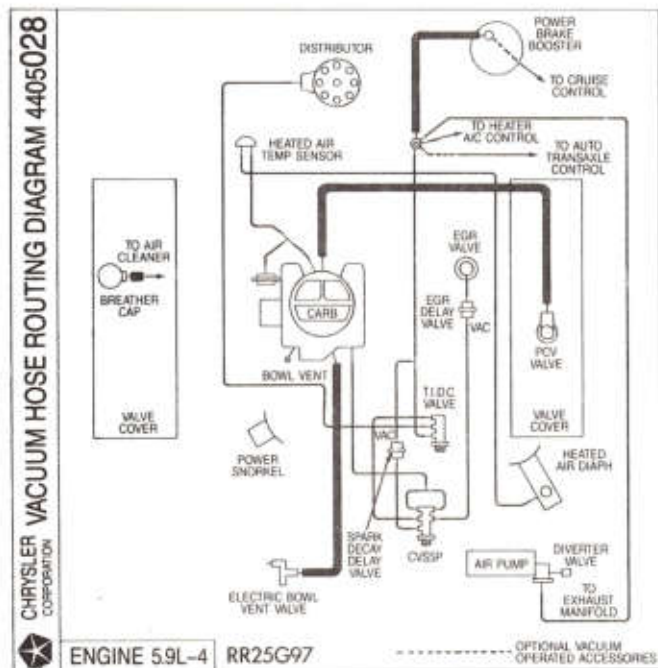


Fig. 9—Vacuum Hose Routing Label Heavy Duty Cycle Canadian 5.9L-4 Engines

ROLLOVER VALVE (5.9L ENGINE)

All vehicles pass a full 360° rollover without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections. A rollover valve is mounted in the top of the fuel tank to prevent fuel leakage if vehicle is accidentally rolled over. Refer to Group 14 Fuel Tank Section for service.

ROLLOVER AND PRESSURE RELIEF VALVE (3.9L AND 5.2L ENGINE)

All fuel injected passenger cars will be equipped with a combination pressure relief and rollover valve. The valve provides path for fuel vapors to travel from the fuel tank to the canister and also provides fuel leakage protection if a vehicle rollover occurs. This valve also incorporates a pressure relief mechanism which is designed to release pressure to the atmosphere when the fuel tank pressure increases above the calibrated sealing valve.

Refer to Group 14 Fuel Tank Section For Service.

PRESSURE-VACUUM FILLER CAP (FIG. 11)

The loss of any fuel or vapor out of the fuel tank filler neck is prevented by the use of a pressure-vacuum filler cap. Relief valves within the cap will release only under significant pressure (1.9 to 2.5 psi) or vacuum (.15 to .30 psi). This cap must be replaced

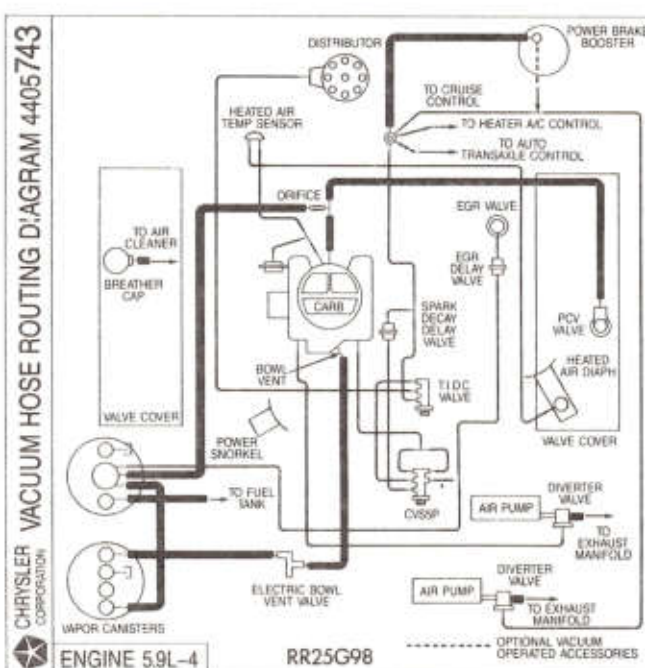


Fig. 10—Vacuum Hose Routing Label Heavy Duty Cycle Federal 5.9L-4 Engines

by a similar unit if replacement is necessary, in order for the system to remain effective.

CAUTION: Remove filler cap prior to removing or repairing any fuel or vent lines.

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM (FIG. 12)

The crankcase ventilation system is designed to eliminate emission of residual fumes and vapors from the crankcase by directing these fumes back through the combustion chamber.

All models are equipped with a closed crankcase

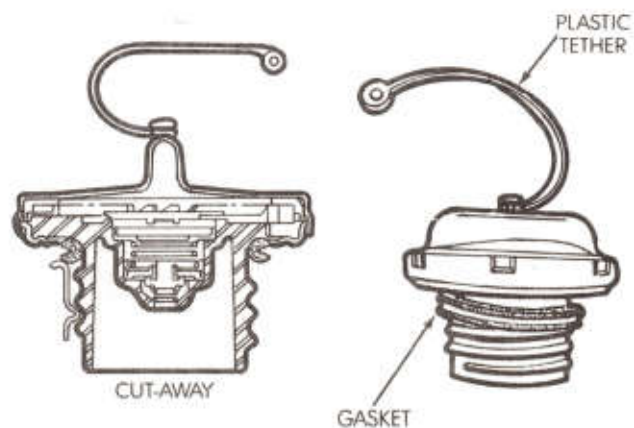


Fig. 11—Pressure Vacuum Filler Cap

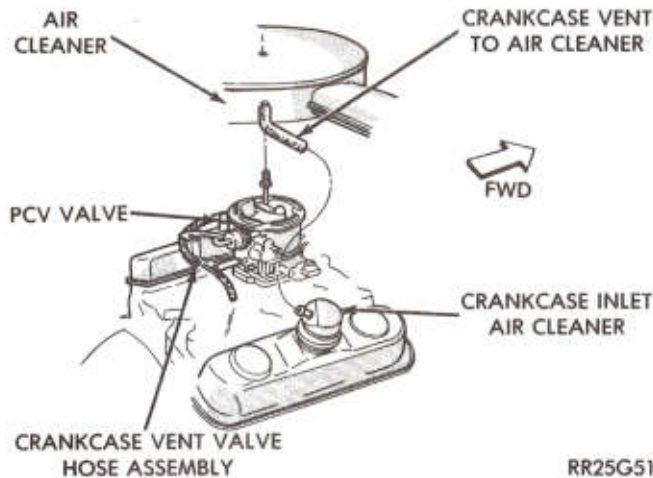


Fig. 12—PCV System

ventilation system (Fig. 13). This system consists of a crankcase PCV valve mounted on the cylinder head cover, with a hose extending from the valve to the base of the carburetor throttle body.

A closed engine oil crankcase inlet air filter with a hose connecting it to the air cleaner housing provides the source of air for the system.

Positive Crankcase Ventilation (PCV) System Operation (Fig. 13)

The ventilation system operates by manifold vacuum: Air is drawn from the air cleaner, through the air cleaner hose to the crankcase inlet air filter, through the crankcase inlet air filter and into the crankcase, circulated through the engine and drawn out through the PCV valve, through the PCV valve hose and into a passage in the carburetor or throttle body, becomes part of the calibrated air/fuel mixture drawn into the combustion chamber, is burned and expelled with the exhaust gases.

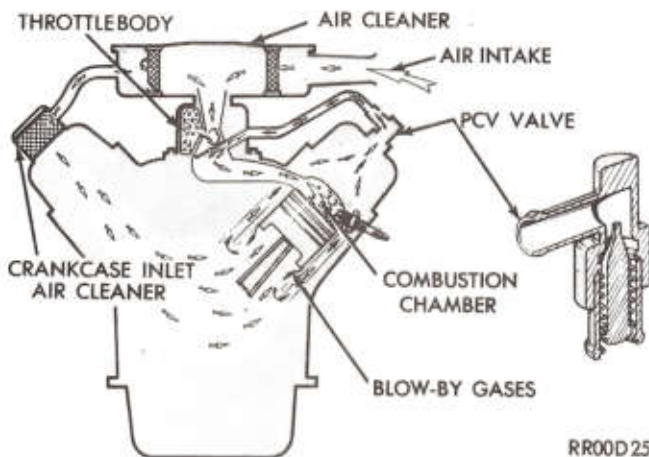


Fig. 13—Typical Closed Crankcase Ventilation System

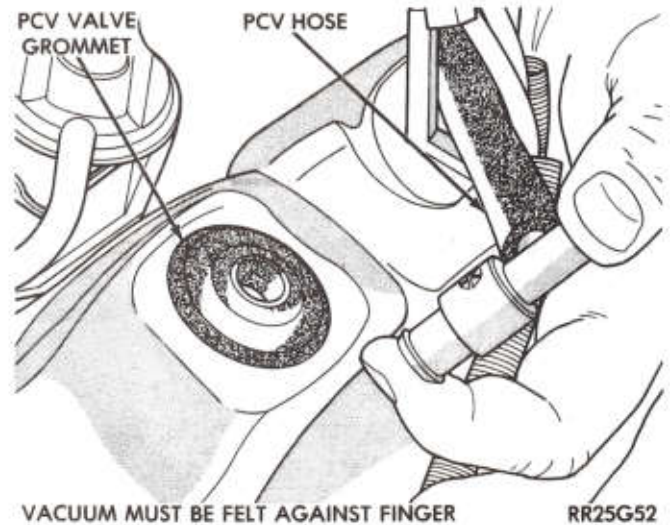


Fig. 14—Check Vacuum at PCV Valve

Inspection and Service Procedure

(1) With engine idling, remove PCV valve from cylinder head cover. If the valve is not plugged, a hissing noise will be heard as air passes through the valve and a strong vacuum should be felt when a finger is placed over the valve inlet. (Fig. 14).

(2) Reinstall the PCV valve then remove the crankcase inlet air cleaner. Hold a piece of stiff paper such as a parts tag loosely over the opening of the cylinder head cover. (Fig. 15).

(3) After allowing approximately one minute for crankcase pressure to reduce, the paper should be drawn against the opening in the cylinder head cover with noticeable force.

(4) Turn off engine and remove PCV valve from

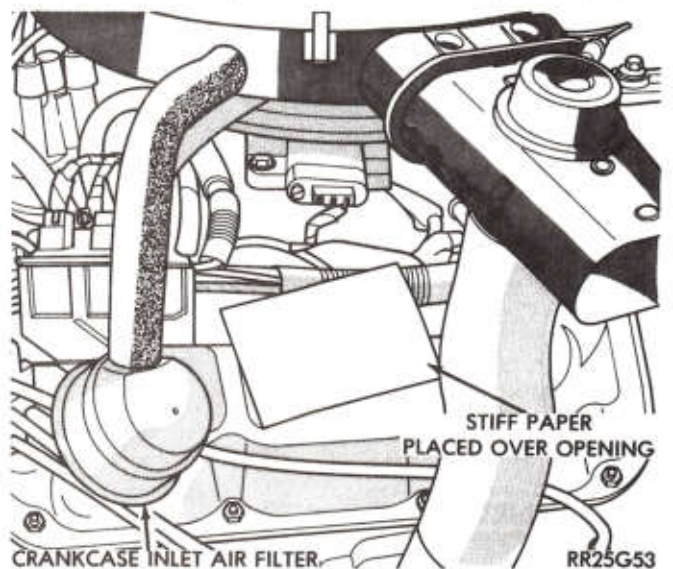


Fig. 15—Check Vacuum at Crankcase Inlet Air Filter Opening

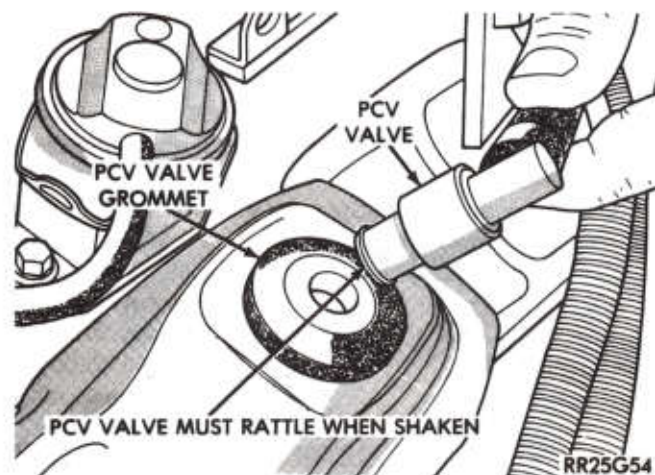


Fig. 16—Shake PCV Valve

cylinder head cover. The valve should rattle when shaken. (Fig. 16).

If the system meets the above tests, no further service is required; if not, the PCV valve should be replaced and the system rechecked. **DO NOT ATTEMPT TO CLEAN THE OLD PCV VALVE.**

(5) With a new PCV valve installed, if the paper is not drawn against the opening in the cylinder head cover, with noticeable force, the PCV valve hose must be replaced and the passage in the carburetor or throttle body must be cleaned.

(6) To clean the carburetor or throttle body passage, remove the carburetor or throttle body and turn a 1/4 inch drill by hand through the passage to dislodge the solid particles then blow out the passage with shop air. If necessary use a smaller drill to avoid removing any metal from the carburetor. **IT IS NOT NECES-**

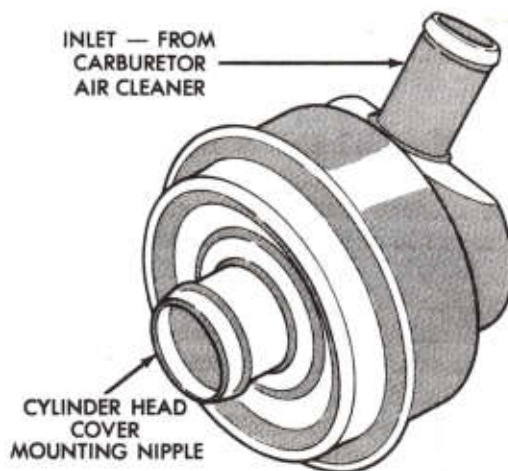


Fig. 17—Crankcase Inlet Filter

SARY TO DISASSEMBLE THE CARBURETOR FOR THIS SERVICE.

CRANKCASE INLET AIR FILTER

The crankcase inlet air filter (Fig. 17) must be kept clean and lubricated. At the recommended interval remove the crankcase inlet air filter and wash it thoroughly in kerosene, or similar solvent. Lubricate or wet the filter, by inverting the crankcase inlet air cleaner and filling with SAE 30 engine oil. Position the air cleaner to allow excess oil to drain thoroughly through the vent nipple. More frequent service may be necessary for vehicles operated extensively on short run, stop and go, or extended engine idle service.